

**PRELIMINARY HYDROLOGY STUDY**  
**FOR**  
**FOX POINT FARMS**  
**1150 QUAIL GARDENS DRIVE, ENCINITAS, CA 92024**

CITY OF ENCINITAS, CA

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## **1.0 EXECUTIVE SUMMARY**

### **1.1 Introduction**

This Preliminary Hydrology Study for the proposed development at 1150 Quail Gardens Drive has been prepared to analyze the hydrologic and hydraulic characteristics of the existing and proposed project site. This report intends to present both the methodology and the calculations used for determining the runoff from the project site in both the pre-developed (existing) conditions and the post-developed (proposed) conditions produced by the 2-year, 10-year, and 100-year, 6-hour storm.

### **1.2 Existing Conditions**

The subject property is located north of Leucadia Boulevard, and is geographically settled between Quail Gardens Drive to the east and Sidonia Street to the west. The site is bordered by single family homes to the west and south; Encinitas Ranch Golf Course to the east, and undeveloped open space to the north. The site consists of greenhouses, processing facilities, one single family residence, fences, storage tanks, and paved access for circulation throughout the site. Existing site topography is generally flat with slopes ranging from 0 to 5 percent and elevations ranging from 310 to 325 feet.

The existing site is comprised of approximately 20.01 acres. In its current state, a majority of the site drains from east to west and enters into Sidonia Street via surface/sheet flow. This is shown as Drainage Area A-1 on the Pre-Development Hydrology Node Map included in Appendix A. Once in Sidonia Street, runoff from Drainage Area A-1 flows north and enters into the existing drainage system located at the intersection of St. Albans Drive. A pre and post development hydrology analysis of the existing system has been included as a part of this study to ensure the proposed project will not negatively impact the existing storm drain system. Results of the offsite analysis are provided in the Conclusions section of this report. Supporting calculations and AES output reports are provided in Appendix E.

Drainage Area A-2 flows northeast via surface flow and is collected in a concrete brow ditch and conveyed north where it discharges into the open space lot located to the north. Drainage Area A-3 travels southeast and is collected in a concrete brow ditch where it is eventually collected and pumped to the existing reservoir located at the southeast corner of Quail Gardens Drive and Leucadia Boulevard. Finally, Drainage Area A-4 flows south into an existing swale and is collected and conveyed east via storm drain and enters into the existing storm drain system within Quail Gardens Drive.

Adopting a City of Encinitas city council requirement for this drainage study, no impervious area credit will be taken for existing greenhouses in the predevelopment condition, however; runoff generated from the greenhouses was included in Section 1.4 for comparison purposes. In the existing condition, pavement and various hardscape results in a 14% impervious basin. Based on infiltration and geotechnical investigations performed on the site, the basin was analyzed assuming Type D soils. Based upon soil type and the amount of existing impervious area onsite, a weighted runoff coefficient of 0.43 was calculated using the

methodology described in Section 3.1.2 of the San Diego County Hydrology Manual and the formula provided therein. Using the Rational Method Procedure outlined in the San Diego County Hydrology Manual, a peak flow rate and time of concentration was calculated for the basin for the 100-year, 6-hour storm event. Refer to the pre-development hydrology calculations included in Appendix B of this report for detailed analysis and the Pre-Development Hydrology Node Map included in Appendix A of this report for pre-development drainage basin delineation and runoff points.

### **1.3 Proposed Project**

The proposed project includes the demolition of all onsite structures and the construction of 250 multi-family homes, a 3,500 SF restaurant, a 10,000 SF recreational center, and approximately 5,000 SF of multi-use event space. Paved private driveways and alleyways as well as onsite grading and supporting infrastructure are also proposed as a part of this development. Proposed pad elevations range from 323 feet at the north end of the property to approximately 313 along the westerly edge of the property.

As shown on the Post-Development Hydrology Node Map, runoff from Drainage Area A-1 sheet flows north into the proposed cross gutter and travels west where it is collected in an inlet. From here runoff is conveyed westerly via storm drain and discharged into the proposed biofiltration basin located directly adjacent to Sidonia Street. After being treated, runoff travels north to a proposed storm water vault where it is stored then metered out into the proposed storm drain system within Sidonia Street. The proposed system eventually connects into the existing system located at the north end of Sidonia Street. Runoff generated in Drainage Areas B-2 and B-3 will be collected via area drains and piped to their respective biofiltration basins where it will be treated and stored. Runoff from these areas will then travel east via storm drain and enter the existing system located within Quail Gardens Drive. Finally, runoff from Drainage Areas A-4 through A-7 will be conveyed west via surface flow and storm drain to the large biofiltration basin along Sidonia Street. Once treated, the runoff will inter into the proposed vault and then connect into the proposed storm drain system within Sidonia Street. Runoff coefficients were calculated for each sub-drainage basin based on methodology described in Section 3.1.2 of the San Diego County Hydrology Manual and the formula provided therein. See Section 2.4 of this report for post-development runoff coefficient calculations. For a breakdown of the pre- and post development peak flow rates for the 100-year, 6-hour storm event, see Section 1.4 of this report.

In an effort to comply with the City of Encinitas' Stormwater standards and the MS4 Permit, all runoff generated onsite will be conveyed to number of biofiltration basins located throughout the site which have been sized for pollution and flow control purposes. As alluded to above, to help supplement the storage capacity provided by the proposed basins along Sidonia Street, a storm water vault is proposed to help meet HMP requirements for the site. Flow rates generated on-site will be controlled via a small low-flow orifice to consistent with HMP requirements as outlined in the City of Encinitas BMP Manual. In larger storm events, runoff not filtered through the engineered soil will be conveyed via an overflow outlet structure consisting of a 3-foot by 3-foot grate located on top of the catch

basin. Runoff conveyed via the outlet structure will bypass the small low-flow orifice and be conveyed directly to the proposed storm drain system in Sidonia Street.

## Conclusions

### Onsite

As illustrated in the Peak Flow Rate Comparison Table shown below, the project has been designed to adequately convey the 100-year, 6-hour storm event. In addition, in the mitigated post development condition, the site has been designed to attenuate the 100-year storm event and reduce flow rates below what is currently leaving the site today. As a result, the project will not adversely affect downstream conditions. For comparison purposes, table 3 includes the runoff generated from the greenhouses.

Peak Flow Rate Comparison Table (100 Year, 6 Hour)			
Pre-Development		Post Development (Unmitigated)	
Drainage Area	Peak Flow (CFS)	Drainage Area	Peak Flow (CFS)
A-1	17.39	A-1, A-4, A-5, A-6, A-7	43.16
A-2	3.32	N/A*	0
A-3	0.41	N/A*	0
A-4	4.70	B-2, B-3	3.32

Peak Flow Rate Comparison Table (100 Year, 6 Hour)			
Pre-Development		Post Development (Mitigated)	
Drainage Area	Peak Flow (CFS)	Drainage Area	Peak Flow (CFS)
A-1	17.39	A-1, A-4, A-5, A-6, A-7	3.03
A-2	3.32	N/A*	0
A-3	0.41	N/A*	0
A-4	4.70	B-2, B-3	3.20

Peak Flow Rate Comparison Table (100 Year, 6 Hour)			
Pre-Development (Greenhouses Included)		Post Development (Mitigated)	
Drainage Area	Peak Flow (CFS)	Drainage Area	Peak Flow (CFS)
A-1	52.87	A-1, A-4, A-5, A-6, A-7	3.03
A-2	8.96	N/A*	0
A-3	1.20	N/A*	0
A-4	11.66	B-2, B-3	3.20

\*Drainage diverted to Sidonia Street

### Offsite

Offsite analysis of the existing and proposed storm drain systems within Sidonia Street has been completed as a part of this study. Though the project is expected to drastically reduce

the runoff leaving the site in the post-development mitigated condition, the proposed storm drain system within Sidonia Street has been sized to convey the unmitigated condition. As shown in the table below, the project is expected to generate approximately 43 CFS in the unmitigated condition. In the mitigated condition this is reduced to roughly 3 CFS. Per the AES hydraulic calculations included in Appendix E, a 24" diameter pipe has been proposed to convey the unmitigated flow rates generated on-site. Per our analysis, we do not anticipate any adverse effects on the existing system within Sidonia. Please refer to Sheet C1.5 for the proposed offsite improvements within Sidonia Street.

Offsite Peak Flow Rate Comparison Table (100 Year, 6 Hour)	
Description	Peak Flow (CFS)
Pre-Development	47.50
Post-Development (Unmitigated)	76.79
Post-Development (Mitigated)	40.91

Please note the improvements associated with the proposed widening of Sidonia Street have been included with this analysis. Please refer to the Offsite Hydrology Analysis Node Map included in Appendix D for more information.

## 1.5 References

*"San Diego County Hydrology Manual"*, revised June 2003, County of San Diego, Department of Public Works, Flood Control Section.

*"San Diego County Drainage Design Manual"*, revised May 2005, County of San Diego, Department of Public Works, Flood Control Section

*"Engineering Design Manual Chapter 7: BMP Design Manual"*, revised February 2016, City of Encinitas

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at <http://websoilsurvey.nrcs.usda.gov>. Accessed May 2015

*"Chapter 7: Encinitas Stormwater Manual"*, Version 1.3, adopted March 17, 2010, City of Encinitas, Engineering Department

## 2.0 METHODOLOGY

### 2.1 Introduction

The hydrologic model used to perform the hydrologic analysis presented in this report utilizes the Rational Method (RM) equation,  $Q = CIA$ . The RM formula estimates the peak rate of runoff based on the variables of area, runoff coefficient, and rainfall intensity. The rainfall intensity (I) is equal to:

$$I = 7.44 \times P_6 \times D^{-0.645}$$

Where:

I = Intensity (in/hr)  
 $P_6$  = 6-hour precipitation (inches)  
 D = duration (minutes – use  $T_c$ )

*Note: The 24-hour P cannot be utilized for the 24-hour intensity per Section 3.1.3 of the County Hydrology Manual*

Using the Time of Concentration ( $T_c$ ), which is the time required for a given element of water that originates at the most remote point of the basin being analyzed to reach the point at which the runoff from the basin is being analyzed. The RM equation determines the storm water runoff rate (Q) for a given basin in terms of flow (typically in cubic feet per second (cfs) but sometimes as gallons per minute (gpm)). The RM equation is as follows:

$$Q = CIA$$

Where:

Q = flow (in cfs)  
 C = runoff coefficient, ratio of rainfall that produces storm water runoff (runoff vs. infiltration/evaporation/absorption/etc)  
 I = average rainfall intensity for a duration equal to the  $T_c$  for the area, in inches per hour.  
 A = drainage area contributing to the basin in acres.

The RM equation assumes that the storm event being analyzed delivers precipitation to the entire basin uniformly, and therefore the peak discharge rate will occur when a raindrop that falls at the most remote portion of the basin arrives at the point of analysis. The RM also assumes that the fraction of rainfall that becomes runoff or the runoff coefficient C is not affected by the storm intensity, I, or the precipitation zone number.

Rational Method calculations were performed using the AES-2016 computer program. To perform the hydrology routing, the total watershed area is divided into sub-areas which

discharge at designated nodes. The procedure for the sub-area summation model is as follows:

1. Subdivide the watershed into an initial sub-area (generally 1 lot) and subsequent sub-areas, which are generally less than 10 acres in size. Assign upstream and downstream node numbers to each sub-area.
2. Estimate an initial  $T_c$  by using the appropriate nomograph or overland flow velocity estimation. The minimum  $T_c$  considered is 5.0 minutes.
3. Using the initial  $T_c$ , determine the corresponding values of  $I$ . Then  $Q = CIA$ .
4. Using  $Q$ , estimate the travel time between this node and the next by Manning's equation as applied to particular channel or conduit linking the two nodes. Then, repeat the calculation for  $Q$  based on the revised intensity (which is a function of the revised time of concentration)

The nodes are joined together by links, which may be street gutter flows, drainage swales, drainage ditches, pipe flow, or various channel flows. The AES computer sub-area menu is as follows:

#### SUBAREA HYDROLOGIC PROCESS

1. Confluence analysis at node.
2. Initial sub-area analysis (including time of concentration calculation).
3. Pipe flow travel time (computer estimated).
4. Pipe flow travel time (user specified).
5. Trapezoidal channel travel time.
6. Street flow analysis through sub-area.
7. User-specified information at node.
8. Addition of sub-area runoff to main line.
9. V-gutter flow through area.
10. Copy main stream data to memory bank
11. Confluence main stream data with a memory bank
12. Clear a memory bank.
31. Compute pipe-flow travel time thru subarea using computer estimated pipe size.
51. Compute trapezoidal channel flow travel time thru subarea.
81. Addition of subarea to mainline peak flow.

At the confluence point of two or more basins, the following procedure is used to combine peak flow rates to account for differences in the basin's times of concentration. This adjustment is based on the assumption that each basin's hydrographs are triangular in shape.

1. If the collection streams have the same times of concentration, then the  $Q$  values are directly summed,

$$Q_p = Q_a + Q_b; T_p = T_a = T_b$$

2. If the collection streams have different times of concentration, the smaller of the tributary Q values may be adjusted as follows:
  - a. The most frequent case is where the collection stream with the longer time of concentration has the larger Q. The smaller Q value is adjusted by a ratio of rainfall intensities.

$$Q_p = Q_b + Q_a (I_b/I_a); T_p = T_a$$

- b. In some cases, the collection stream with the shorter time of concentration has the larger Q. Then the smaller Q is adjusted by a ratio of the T values.

$$Q_p = Q_b + Q_a (T_b/T_a); T_p = T_b$$

## 2.2 County of San Diego Criteria

As defined by the San Diego County Hydrology Manual (SDCHM) dated June 2003, the Rational Method is the preferred equation for determining the hydrologic characteristics of basins up to approximately one square mile in size. The County of San Diego has developed its own tables, nomographs, and methodologies for analyzing storm water runoff for areas within the county. The County has also developed precipitation isopluvial contour maps that show even lines of rainfall anticipated from a given storm event (i.e. 100-year, 6-hour storm).

One of the variables of the RM equation is the runoff coefficient, C. The runoff coefficient is dependent only upon land use and soil type and the County of San Diego has developed a table of Runoff Coefficients for Urban Areas to be applied to basin located within the County of San Diego. The table categorizes the land use, the associated development density (dwelling units per acre) and the percentage of impervious area. Each of the categories listed has an associated runoff coefficient, C, for each soil type class.

The County has also illustrated in detail the methodology for determining the Time of Concentration, in particular the Initial Time of Concentration (Ti). The County has adopted the Federal Aviation Agency's (FAA) overland time of flow equation. This equation essentially limits the flow path length for the initial time of concentration to lengths under 100 feet, and is dependent on land use and slope. See the "Rational Formula – Overland Time of Flow Nomograph," shown in Figure 3-3 or Table 3-2 of the San Diego County Hydrology Manual (June 2003).

The travel time (Tt) is computed by dividing the length of the flow path by the computed velocity. Figure 3-6 of the SDCHM is used to estimate time of travel for street gutter flow. Velocity in a channel is estimated by using the nomograph shown in Figure 3-7 (Manning's Equation Nomograph). Travel time in natural watersheds is calculated from the Kirpich nomograph in Figure 3-4 or from the Kirpich equation.

See Appendix B of this report for San Diego County Hydrology Manual reference material.

### 2.3 City of Encinitas Standards

The City of Encinitas has additional requirements for hydrology reports which are outlined in the Grading, Erosion and Sediment Control Ordinance. Please refer to this manual for further details. The drainage analysis used in this study is also consistent with the requirements set forth in Section 2.3 of the City of Encinitas Engineering Design Manual.

### 2.4 Runoff Coefficient Determination

In accordance with County of San Diego standards, runoff coefficients were based on land use and soil type. The soil condition used in this study is consistent with Type D soil quantities. An appropriate runoff coefficient (C) for each type of land use in the subarea was selected from Table 3-1 of the San Diego County Hydrology Manual and multiplied by the percentage of total area (A) included in that class. The sum of products for all land uses is the weighted runoff coefficient ( $\sum[C]$ ). See the table below for weighted runoff coefficient “C” calculations. The Existing and Post-Development Hydrology Maps show the drainage basin subareas, on-site drainage system and nodal points.

$$\underline{\sum C} = \frac{C_1 A_1 + C_2 A_2}{A_1 + A_2}$$

Summary of Existing Condition Weighted Runoff Coefficients						
Drainage Basin	Total Area, A (ac)	C <sub>1</sub>	A <sub>1</sub>	C <sub>2</sub>	A <sub>1</sub>	C
A	20.02	0.9	2.80	0.35	17.22	0.43

Summary of Post-Development Condition Weighted Runoff Coefficients						
Drainage Area	Total Area, A (ac)	C <sub>1</sub>	A <sub>1</sub>	C <sub>2</sub>	A <sub>1</sub>	C
A1	1.74	0.9	1.22	0.35	0.52	0.74
A2	4.64	0.9	3.25	0.35	1.39	0.74
A3	5.04	0.9	3.53	0.35	1.51	0.74
A4	6.32	0.9	0.71	0.35	5.61	0.41
A5	0.62	0.9	0.46	0.35	0.16	0.76
B1	0.44	0.9	0.24	0.35	0.20	0.65
B2	0.59	0.9	0.27	0.35	0.32	0.60

### 2.5 Hydraulics

The hydraulics of existing and proposed storm drain pipes were analyzed using the AES computer program. For pipe flow, a Manning's N value of 0.013 was used to reflect the use of HDPE and RCP pipe. All proposed storm drain pipes have been sized based on the proposed unmitigated flow condition for the 100-year storm event. Curb inlet and catch basin capacity calculations will be provided upon final engineering.

## 2.6 Detention Analysis

The HMP Biofiltration basins (BMP) provide pollutant control, hydromodification management flow control and mitigation of the 100-year storm event peak flow rate. The 100-year storm event detention analysis was performed using HydroCAD Stormwater Modeling software. The inflow runoff hydrographs to the BMPs were modeled using RatHydro which is a Rational Method Design Storm Hydrograph software that creates a hydrograph using the results of the Rational Method calculations. HydroCAD has the ability to route the 100-year 6-hour storm event inflow hydrographs through the BMPs and based on the BMP cross sectional geometry, stage storage and outlet structure data, HydroCAD calculates the detained peak flow rates and detained times to peak.

Summary of Detention Basin Routing						
BMP	Node	Tributary Area (ac)	Tc in (min)	Tc out (min)	Q100 in (cfs)	Q100 out (cfs)
BMP A1	100.4	1.74	9.12	13.92	5.68	0.75
BMP A2	100.6	4.65	10.13	19.53	14.23	0.96
BMP A3	100.8	5.04	11.12	21.92	14.48	0.90
BMP A4	100.1	6.32	14.39	20.89	8.62	5.28
BMP A5	600.2	0.62	5.45	5.55	2.91	2.87
VAULT	100.12	17.80	20.98	104.58	7.85	2.38
BMP B1	200.1	0.44	7.15	7.55	1.48	1.42
BMP B2	300.2	0.59	7.90	8.10	1.87	1.83

The detained flow rates and time of concentrations from the detention basins were then entered into the project's AES hydrologic study using Process Code 7 (see Section 2.1 of this report for summary of AES process codes). A mitigated condition AES report was produced for the 100-year storm event. See Appendix C for proposed mitigated condition hydrologic calculations. HydroCAD detention output reports will be provided upon final engineering.

The HMP Biofiltration facilities consists of a basin with 18 inches of engineered soil and permavoid storage layer of varying depths. Runoff will be biofiltered through the engineered soil and permavoid layers, then collected in a series of small PVC drainpipes and directed to a catch basin located in the HMP Biofiltration basin where runoff will be mitigated via a small HMP orifice to comply with HMP requirements. In larger storm events, runoff not filtered through the engineered soil and permavoid layers will be conveyed via an overflow outlet structure. Runoff conveyed via the outlet structure will

bypass the small HMP orifice and be conveyed directly to the proposed storm drain discharge pipe.

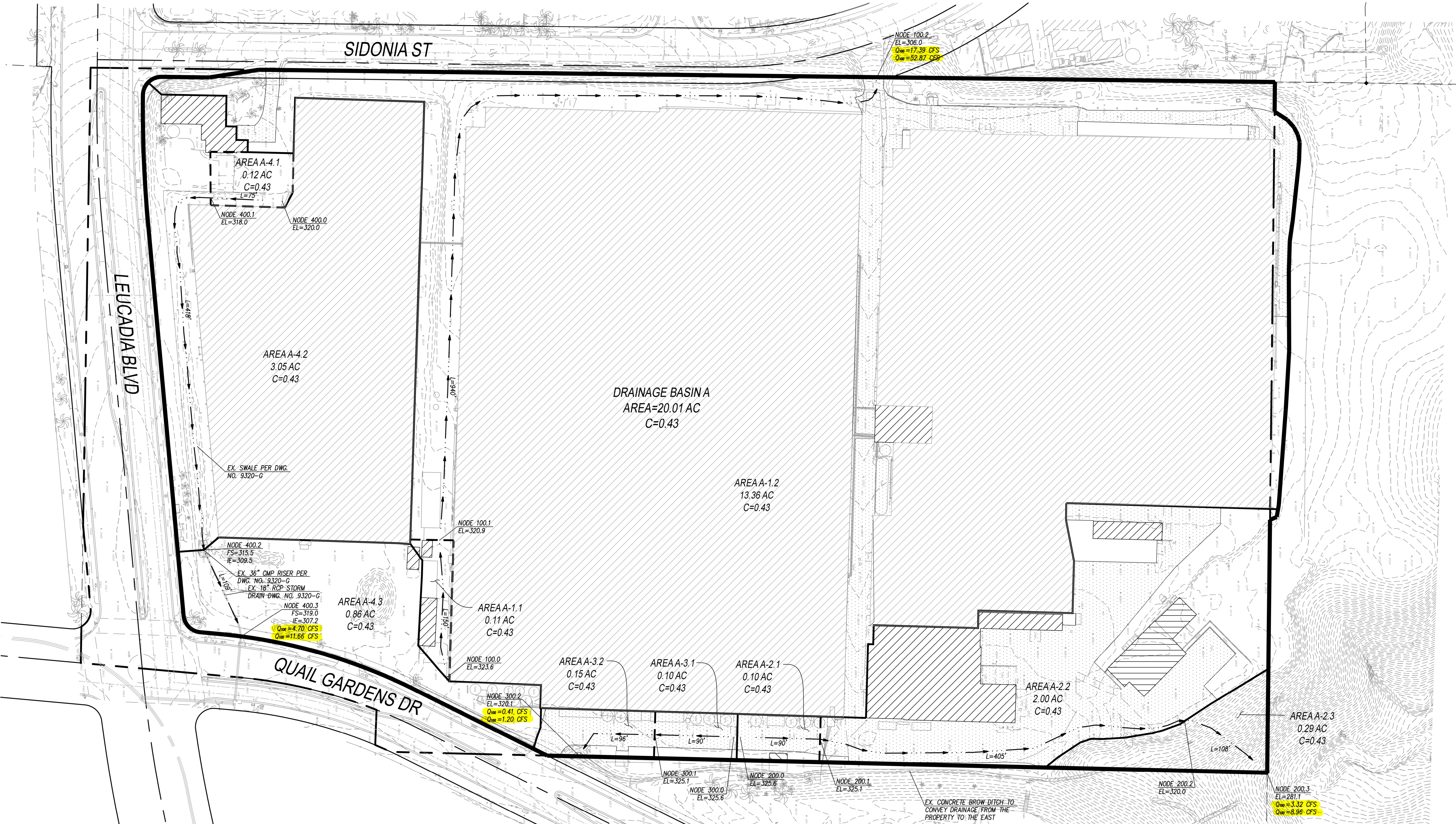
Based on the results of the HydroCAD analysis, the HMP Biofiltration facilities provide mitigation for the 100-year storm event peak flow rate, detaining the proposed condition Drainage A Q100 to 3.03 cfs, which is below the existing condition Q100 of 17.39 cfs, and detaining the proposed condition Drainage B Q100 to 3.20 cfs, which is below the existing condition Q100 of 4.70 cfs. Refer to Appendix C for the proposed mitigated condition hydrologic calculations.

## **APPENDIX A**

### **Pre and Post Development Hydrology Node Maps**

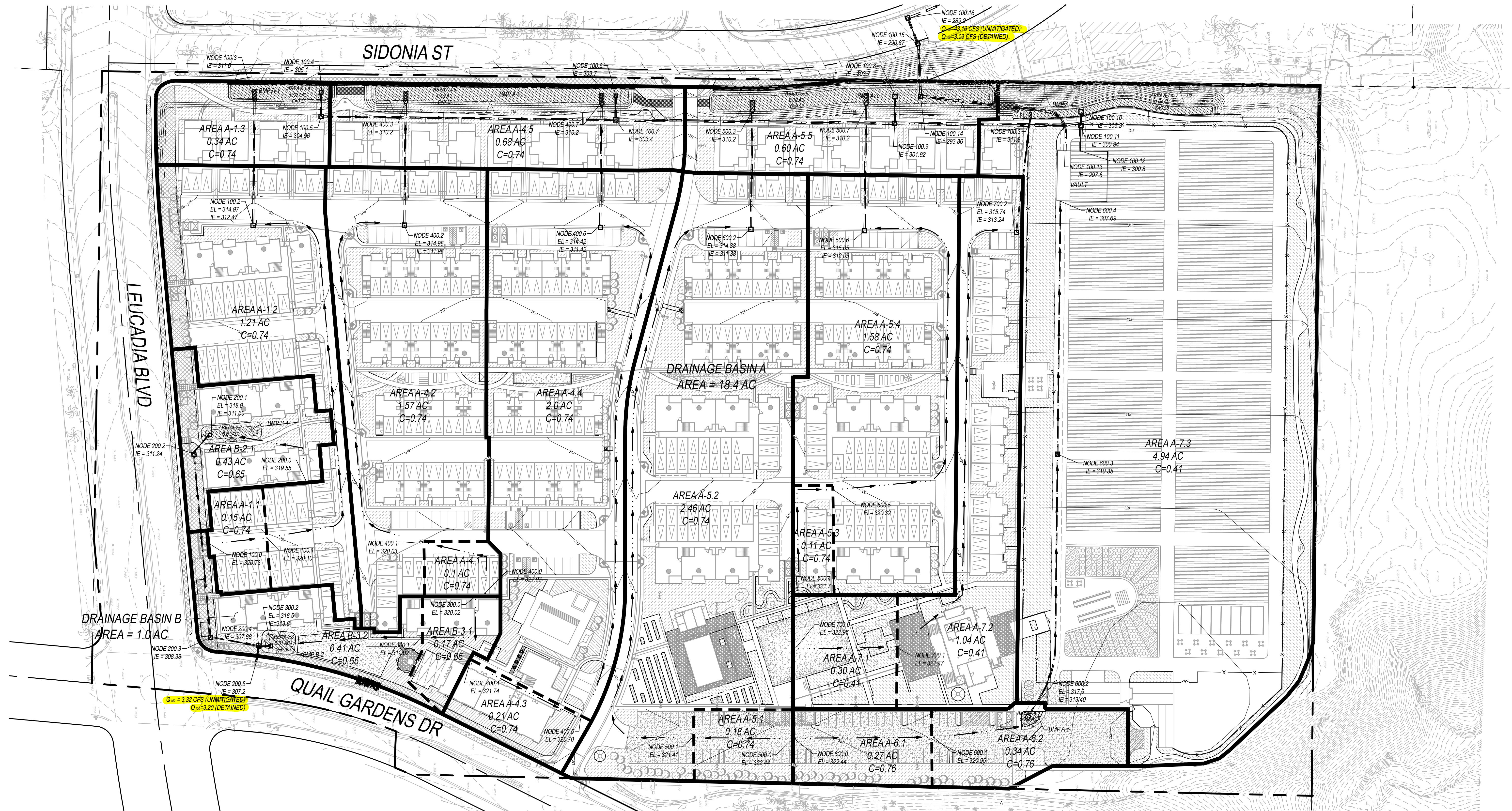
# PRE-DEVELOPMENT HYDROLOGY NODE MAP

## FOX POINT, ENCINITAS, CA



# POST-DEVELOPEMENT HYDROLOGY NODE MAP

## FOX POINT, ENCINITAS, CA



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## **APPENDIX B**

### **Hydrology Support Material**

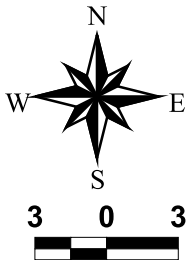
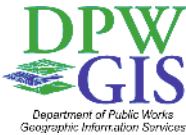
# County of San Diego Hydrology Manual



## *Rainfall Isophuvials*

### **2 Year Rainfall Event - 6 Hours**

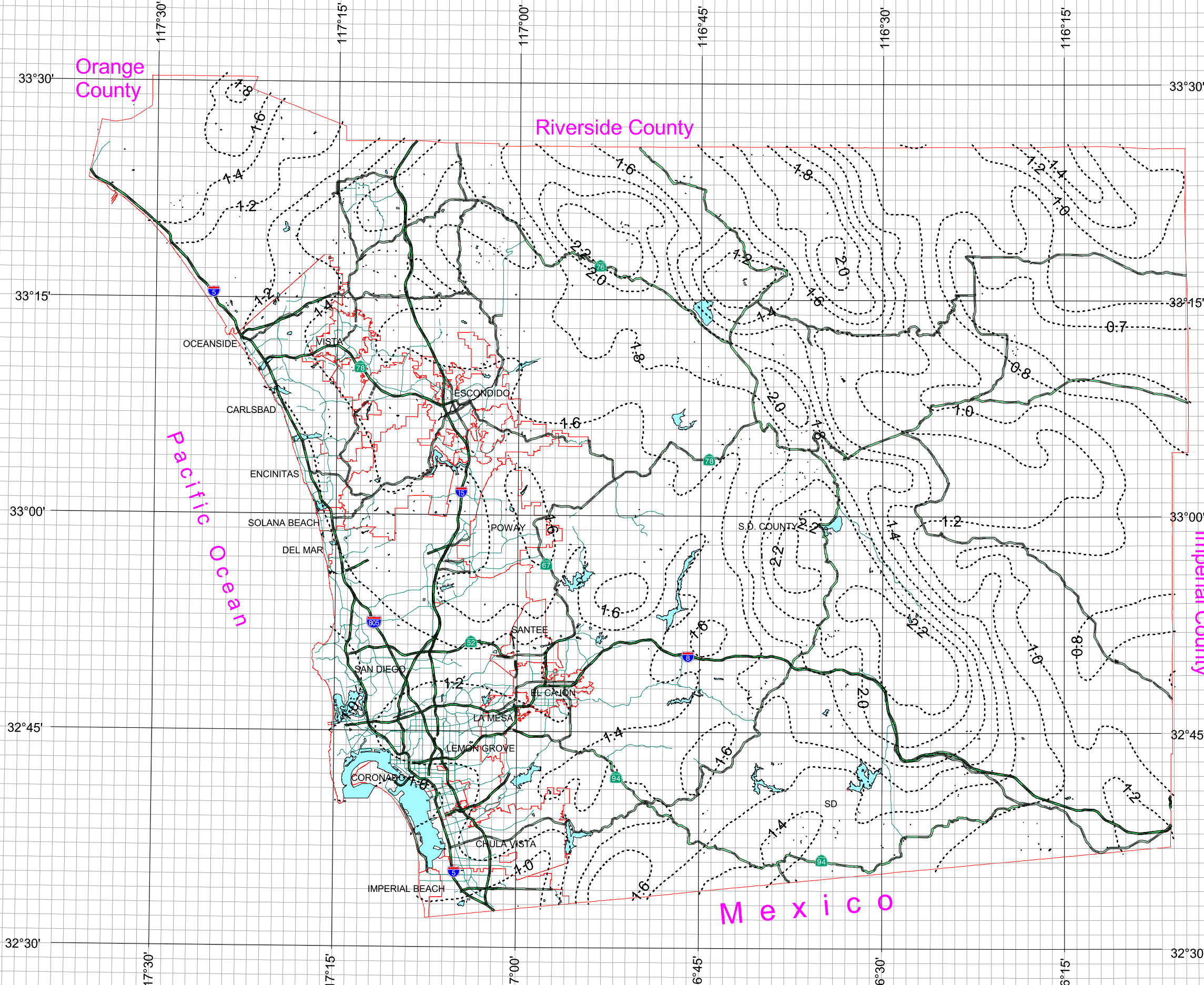
----- Isopluvial (inches)



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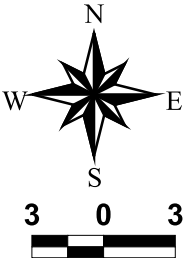
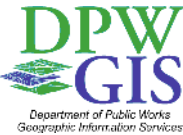
# County of San Diego Hydrology Manual



## Rainfall Isopluvials

### 10 Year Rainfall Event - 6 Hours

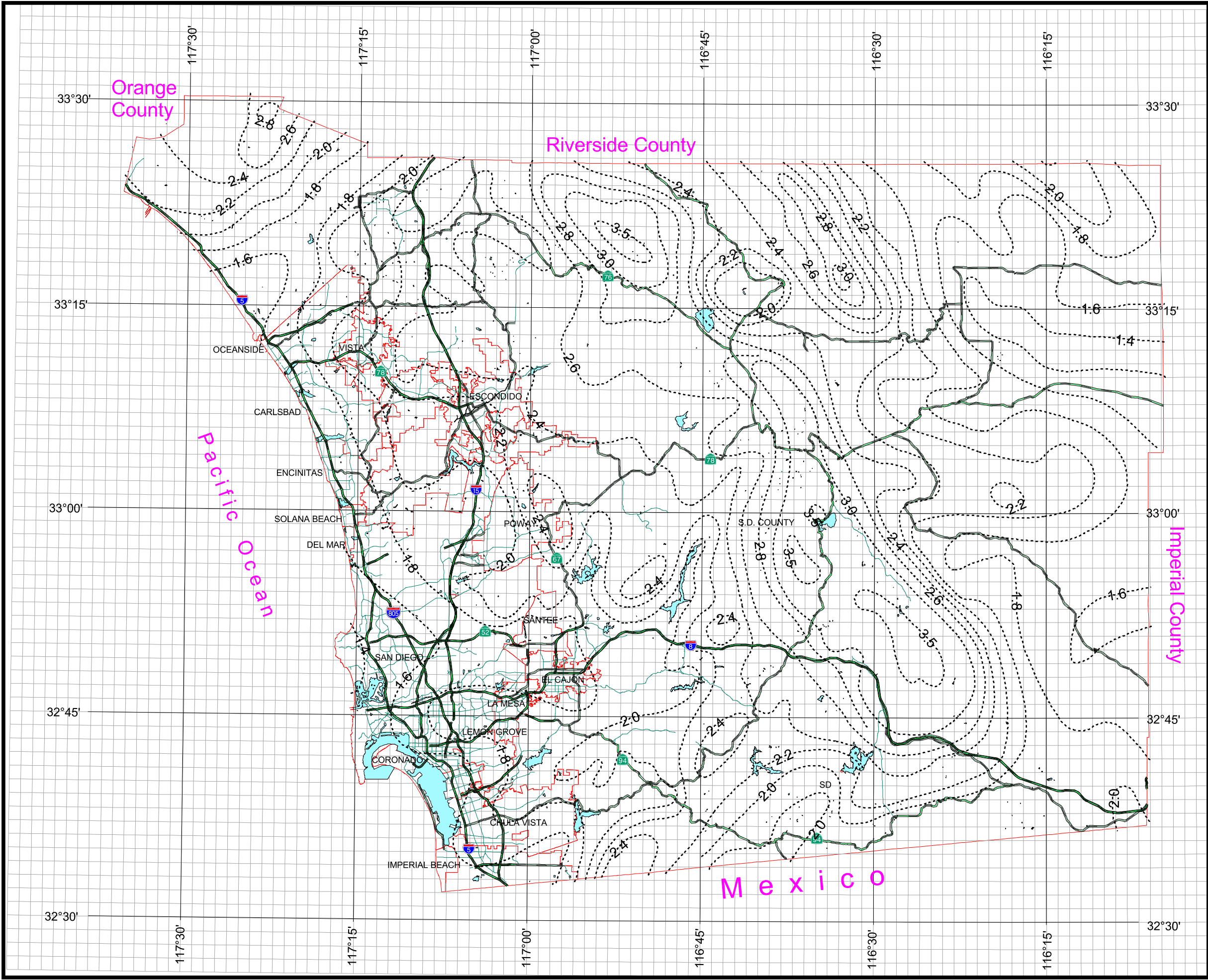
----- Isopluvial (inches)



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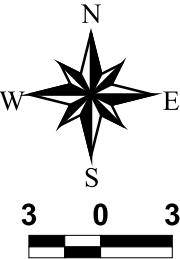
# County of San Diego Hydrology Manual



## Rainfall Isopluvials

### 100 Year Rainfall Event - 6 Hours

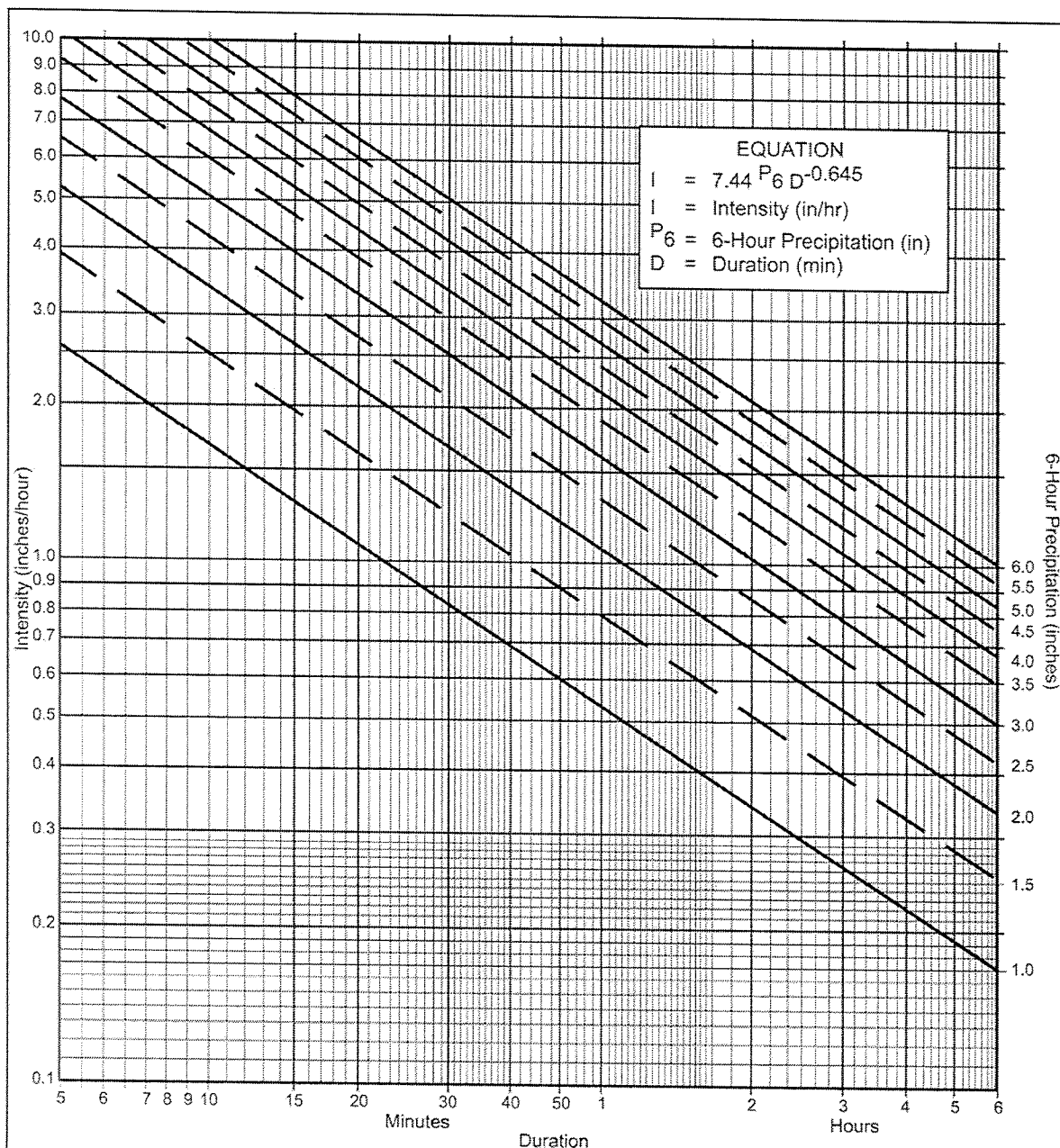
----- Isopluvial (inches)



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#### Directions for Application:

- (1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).
- (2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).
- (3) Plot 6 hr precipitation on the right side of the chart.
- (4) Draw a line through the point parallel to the plotted lines.
- (5) This line is the intensity-duration curve for the location being analyzed.

#### Application Form:

- (a) Selected frequency \_\_\_\_\_ year
- (b)  $P_6 = \underline{2.5}$  in.,  $P_{24} = \underline{4.5}$ ,  $\frac{P_6}{P_{24}} = \underline{55.6} \%^{(2)}$
- (c) Adjusted  $P_6^{(2)} = \underline{2.5}$  in.
- (d)  $t_x = \underline{8.9}$  min.
- (e)  $I = \underline{4.54}$  in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.59	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

**Table 3-1  
RUNOFF COEFFICIENTS FOR URBAN AREAS**

Land Use		Runoff Coefficient "C"				
NRCS Elements	County Elements	% IMPER.	Soil Type			
			A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

\*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient,  $C_p$ , for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

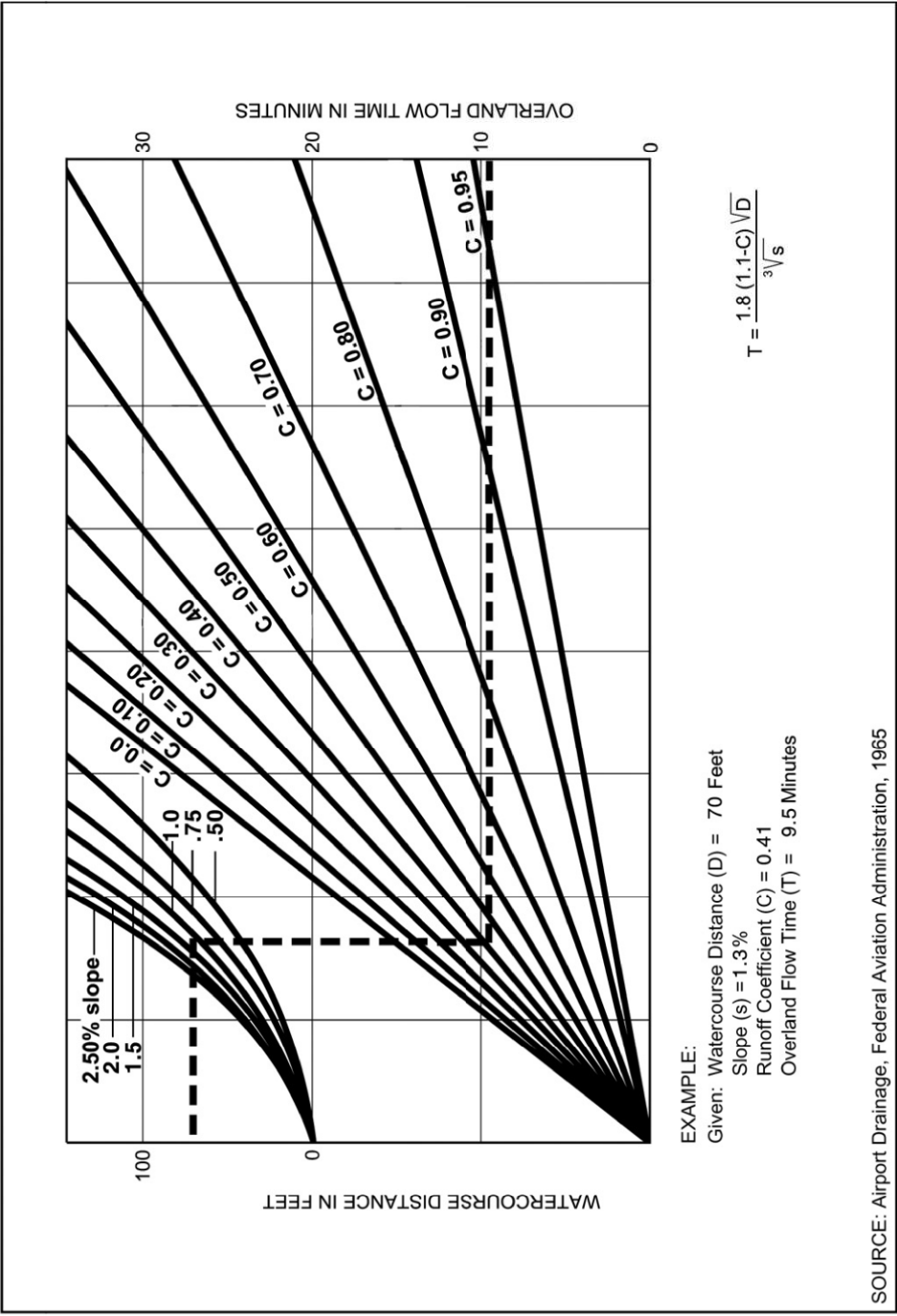
Table 3-2 provides limits of the length (Maximum Length ( $L_M$ )) of sheet flow to be used in hydrology studies. Initial  $T_i$  values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the “Regulating Agency” when submitted with a detailed study.

**Table 3-2**

**MAXIMUM OVERLAND FLOW LENGTH ( $L_M$ )  
& INITIAL TIME OF CONCENTRATION ( $T_i$ )**

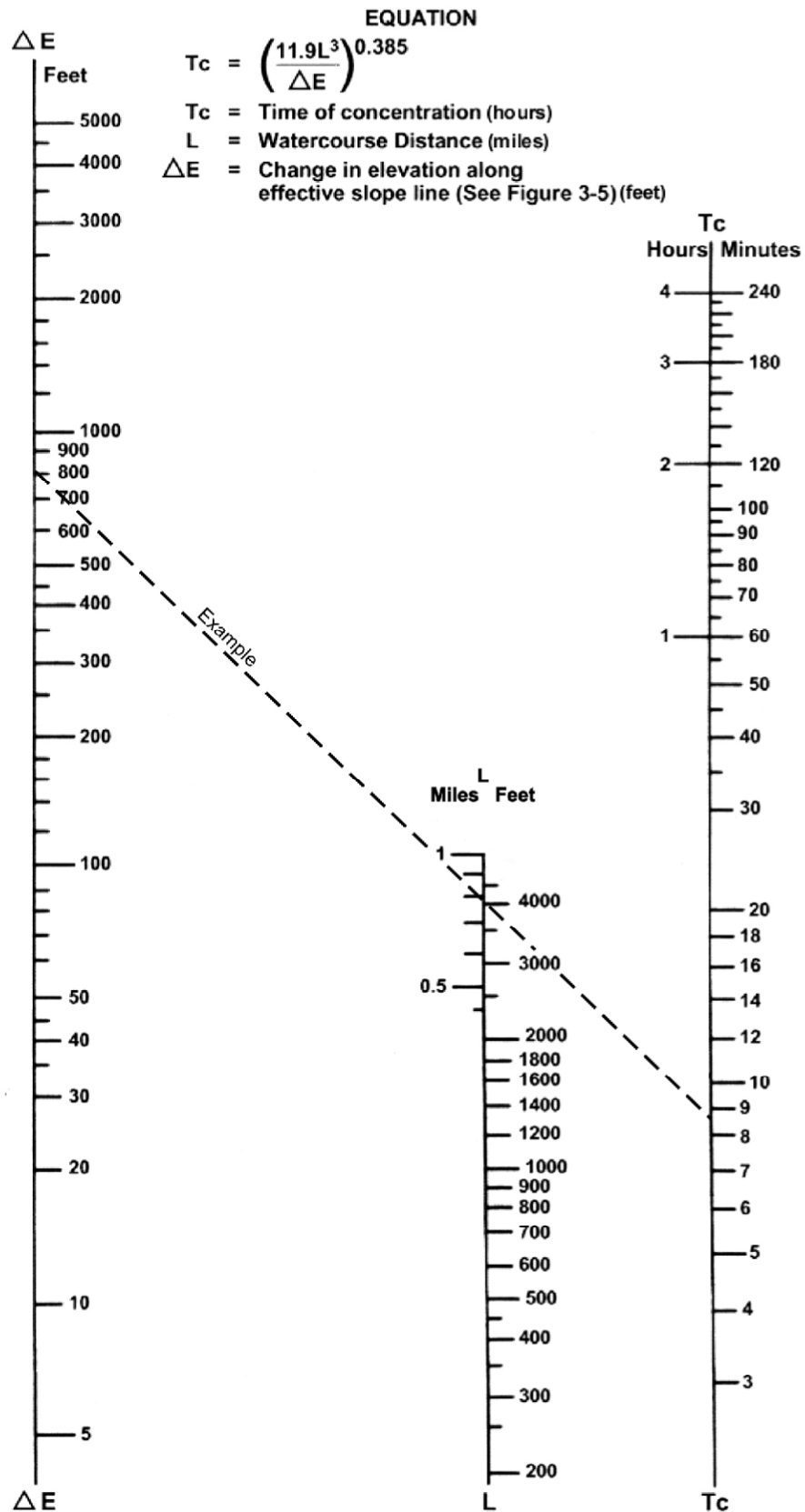
Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		$L_M$	$T_i$	$L_M$	$T_i$	$L_M$	$T_i$	$L_M$	$T_i$	$L_M$	$T_i$	$L_M$	$T_i$
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

\*See Table 3-1 for more detailed description



FIGURE

Rational Formula - Overland Time of Flow Nomograph

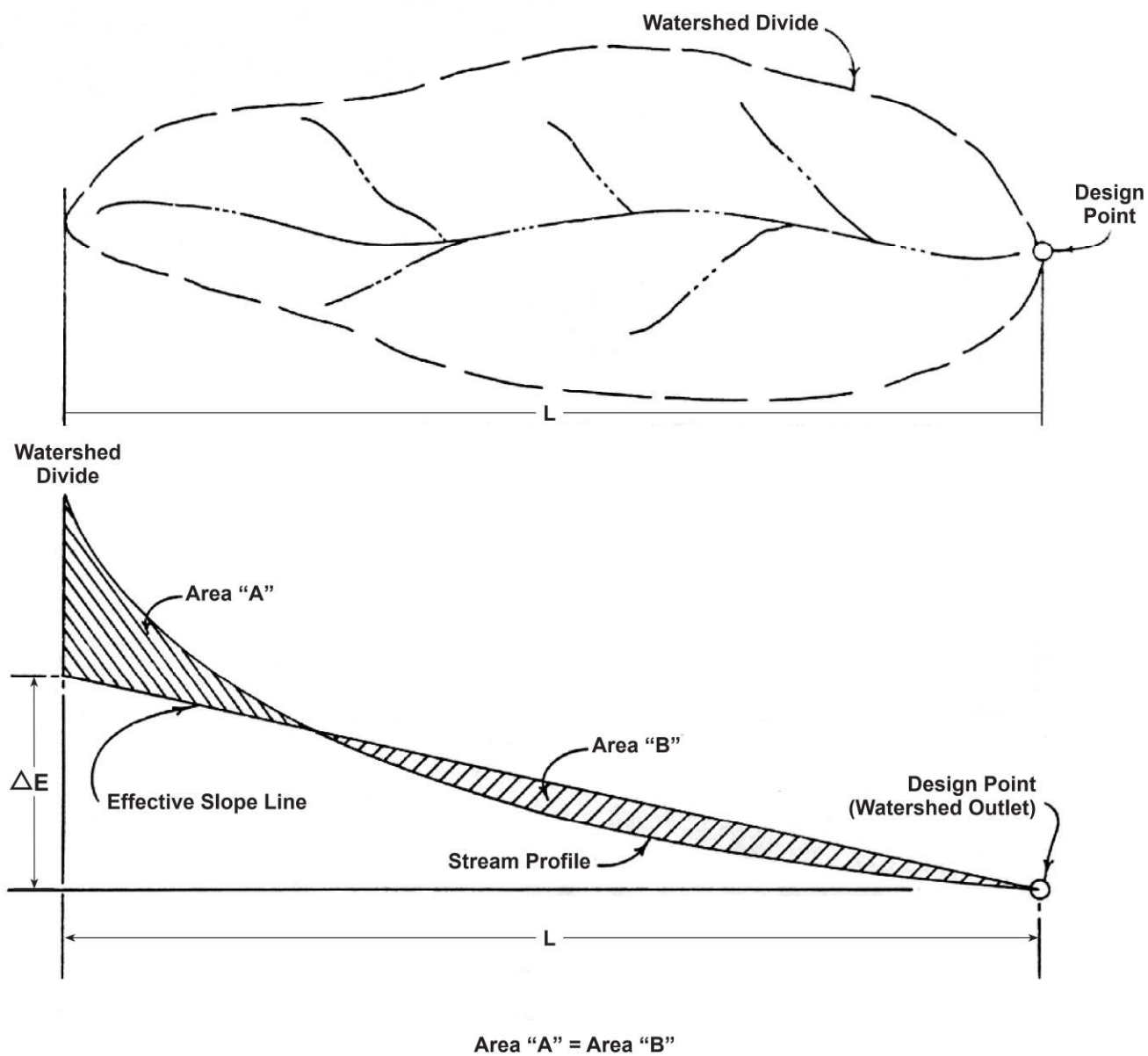


SOURCE: California Division of Highways (1941) and Kirpich (1940)

Nomograph for Determination of  
Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ ) for Natural Watersheds

FIGURE

3-4

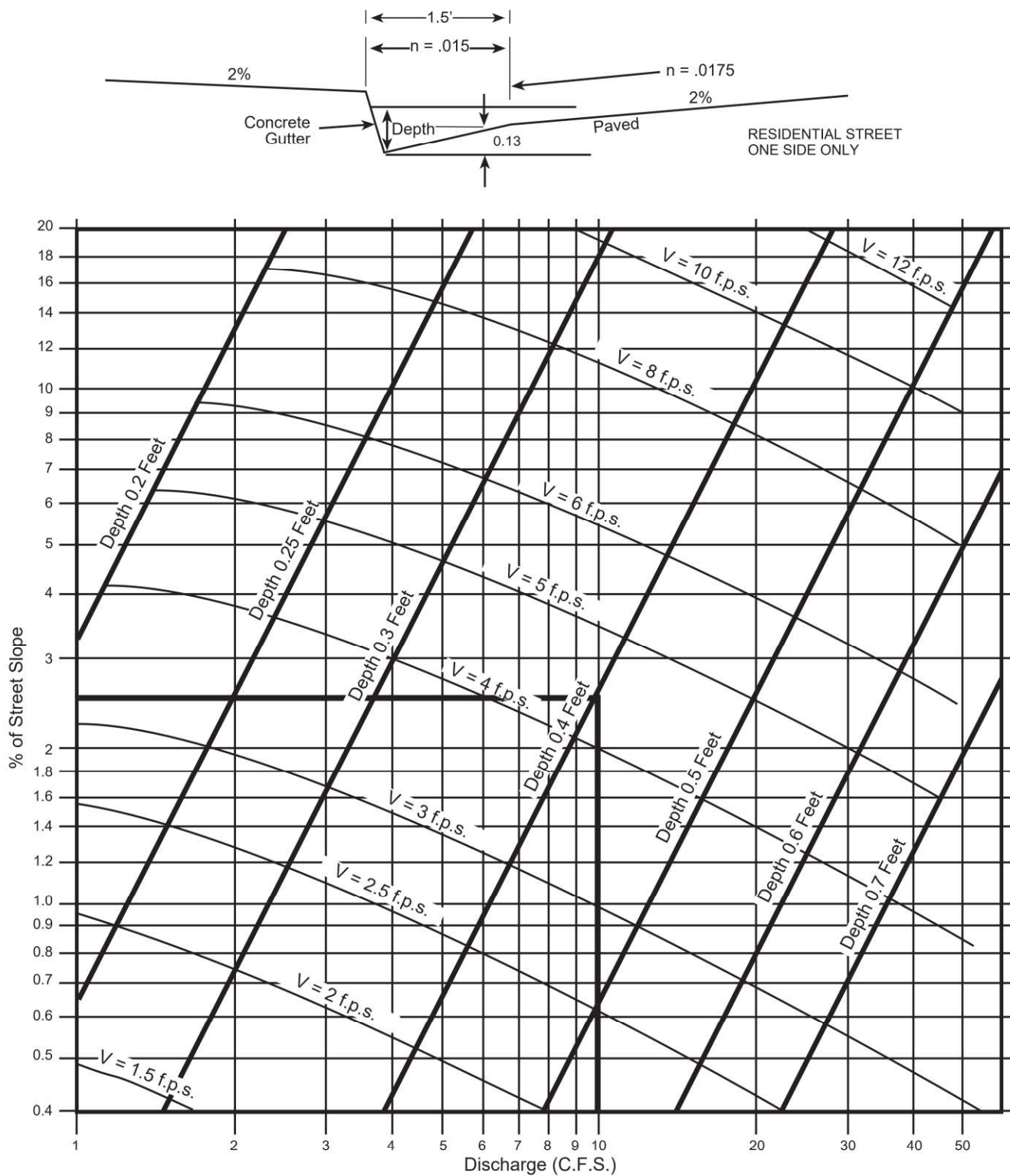


SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

Computation of Effective Slope for Natural Watersheds

3-5



**EXAMPLE:**

Given:  $Q = 10$   $S = 2.5\%$

Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

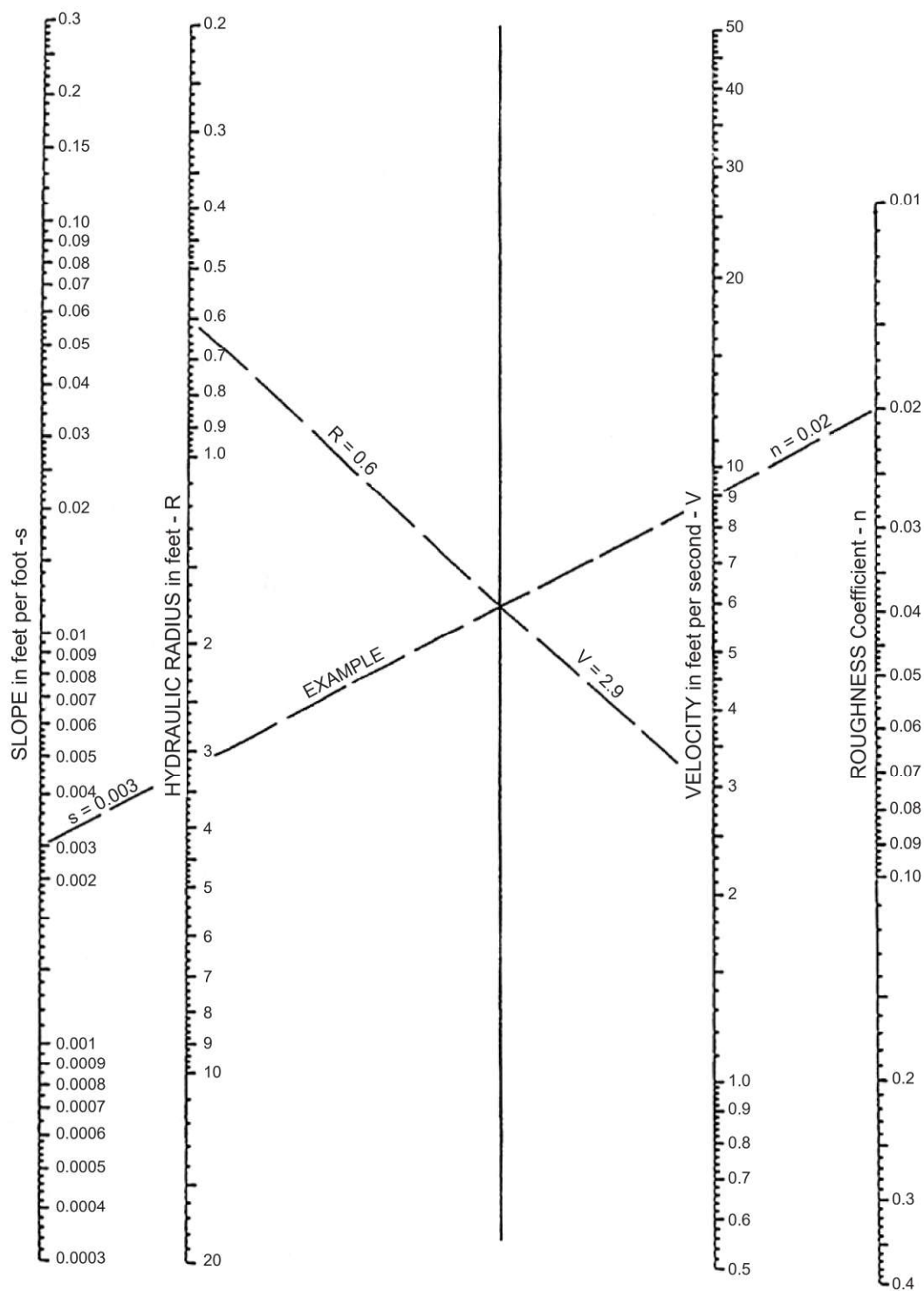
SOURCE: San Diego County Department of Special District Services Design Manual

**Gutter and Roadway Discharge - Velocity Chart**

**FIGURE**

**3-6**

$$\text{EQUATION: } V = \frac{1.49}{n} R^{2/3} s^{1/2}$$



GENERAL SOLUTION

SOURCE: USDOT, FHWA, HDS-3 (1961)

FIGURE

Manning's Equation Nomograph


3-7

# Soil Map—San Diego County Area, California




## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California

Survey Area Data: Version 14, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 3, 2014—Nov 22, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AtE	Altamont clay, 15 to 30 percent slopes, warm MAAT, MLRA 20	0.7	1.4%
CbB	Carlsbad gravelly loamy sand, 2 to 5 percent slopes	27.8	57.1%
CfB	Chesterton fine sandy loam, 2 to 5 percent slopes	5.8	11.8%
CID2	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded	5.8	12.0%
RuG	Rough broken land	7.9	16.2%
SbC	Salinas clay loam, 2 to 9 percent slopes	0.7	1.4%
<b>Totals for Area of Interest</b>		<b>48.6</b>	<b>100.0%</b>

## **APPENDIX C**

### **AES Pre and Post-Development Output Reports**

## **AES Pre-Development Output Report**

## PRE-DEVELOPMENT CONDITION

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
2003,1985,1981 HYDROLOGY MANUAL  
(c) Copyright 1982-2008 Advanced Engineering Software (aes)  
Ver. 15.0 Release Date: 04/01/2008 License ID 1452

Analysis prepared by:

PASCO LARET SUITER & ASSOCIATES  
535 NORTH HIGHWAY 101  
SUITE A  
SOLANA BEACH CA 92705

-----  
FILE NAME: 3084EXA1.DAT  
TIME/DATE OF STUDY: 09:01 05/08/2020  
-----

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

-----  
2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00  
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95  
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD  
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*  
      HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING  
      WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR  
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)  
=== =====  
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0312 0.167 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.50 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN  
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*

\*\*\*\*\*

FLOW PROCESS FROM NODE 100.00 TO NODE 100.10 IS CODE = 21

-----  
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<  
=====

\*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .4300  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 150.00  
UPSTREAM ELEVATION(FEET) = 323.60  
DOWNSTREAM ELEVATION(FEET) = 320.90  
ELEVATION DIFFERENCE(FEET) = 2.70

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 8.978

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 82.00

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.516

SUBAREA RUNOFF(CFS) = 0.21

TOTAL AREA(ACRES) = 0.11 TOTAL RUNOFF(CFS) = 0.21

\*\*\*\*\*  
FLOW PROCESS FROM NODE 100.10 TO NODE 100.20 IS CODE = 51  
-----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	320.90	DOWNSTREAM(FEET) =	306.00
CHANNEL LENGTH THRU SUBAREA(FEET) =	940.00	CHANNEL SLOPE =	0.0159
CHANNEL BASE(FEET) =	10.00	"Z" FACTOR =	50.000
MANNING'S FACTOR =	0.030	MAXIMUM DEPTH(FEET) =	1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	2.913		
*USER SPECIFIED(SUBAREA):			
USER-SPECIFIED RUNOFF COEFFICIENT =	.4300		
S.C.S. CURVE NUMBER (AMC II) =	0		
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =	9.08		
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =	1.79		
AVERAGE FLOW DEPTH(FEET) =	0.23	TRAVEL TIME(MIN.) =	8.74
Tc(MIN.) =	17.71		
SUBAREA AREA(ACRES) =	13.77	SUBAREA RUNOFF(CFS) =	17.25
AREA-AVERAGE RUNOFF COEFFICIENT =	0.430		
TOTAL AREA(ACRES) =	13.9	PEAK FLOW RATE(CFS) =	17.39

END OF SUBAREA CHANNEL FLOW HYDRAULICS:  
DEPTH(FEET) = 0.32 FLOW VELOCITY(FEET/SEC.) = 2.12  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.20 = 1090.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES)	=	13.9	TC(MIN.) =	17.71
PEAK FLOW RATE(CFS)	=	17.39		

=====

=====

END OF RATIONAL METHOD ANALYSIS

## PRE-DEVELOPMENT CONDITION

\*\*\*\*\*

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Ver. 15.0 Release Date: 04/01/2008 License ID 1452

Analysis prepared by:

PASCO LARET SUITER & ASSOCIATES  
535 NORTH HIGHWAY 101  
SUITE A  
SOLANA BEACH CA 92705

-----  
FILE NAME: 3084EXA2.DAT  
TIME/DATE OF STUDY: 09:12 05/08/2020  
-----

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

-----  
2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00  
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95  
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD  
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*  
HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING  
WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR  
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)  
=== =====  
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0312 0.167 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.50 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN  
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*

\*\*\*\*\*

FLOW PROCESS FROM NODE 200.00 TO NODE 200.10 IS CODE = 21

-----  
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<  
=====

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4300  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 90.00  
UPSTREAM ELEVATION(FEET) = 325.60  
DOWNSTREAM ELEVATION(FEET) = 325.10  
ELEVATION DIFFERENCE(FEET) = 0.50  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 10.601  
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN  
THE MAXIMUM OVERLAND FLOW LENGTH = 52.22  
(Reference: Table 3-1B of Hydrology Manual)  
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.057  
SUBAREA RUNOFF(CFS) = 0.17

TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.17

\*\*\*\*\*  
FLOW PROCESS FROM NODE 200.10 TO NODE 200.20 IS CODE = 51  
-----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 325.10 DOWNSTREAM(FEET) = 320.00  
CHANNEL LENGTH THRU SUBAREA(FEET) = 405.00 CHANNEL SLOPE = 0.0126  
CHANNEL BASE(FEET) = 10.00 "Z" FACTOR = 50.000  
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.286  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4300  
S.C.S. CURVE NUMBER (AMC II) = 0  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.60  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.65  
AVERAGE FLOW DEPTH(FEET) = 0.07 TRAVEL TIME(MIN.) = 4.10  
Tc(MIN.) = 14.70  
SUBAREA AREA(ACRES) = 2.00 SUBAREA RUNOFF(CFS) = 2.83  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.430  
TOTAL AREA(ACRES) = 2.1 PEAK FLOW RATE(CFS) = 2.97

END OF SUBAREA CHANNEL FLOW HYDRAULICS:  
DEPTH(FEET) = 0.10 FLOW VELOCITY(FEET/SEC.) = 1.93  
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.20 = 495.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 200.20 TO NODE 200.30 IS CODE = 51  
-----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 320.00 DOWNSTREAM(FEET) = 281.10  
CHANNEL LENGTH THRU SUBAREA(FEET) = 108.00 CHANNEL SLOPE = 0.3602  
CHANNEL BASE(FEET) = 10.00 "Z" FACTOR = 50.000  
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 1.00  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.226  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .4300  
S.C.S. CURVE NUMBER (AMC II) = 0  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.17  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.22  
AVERAGE FLOW DEPTH(FEET) = 0.06 TRAVEL TIME(MIN.) = 0.43  
Tc(MIN.) = 15.12  
SUBAREA AREA(ACRES) = 0.29 SUBAREA RUNOFF(CFS) = 0.40  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.430  
TOTAL AREA(ACRES) = 2.4 PEAK FLOW RATE(CFS) = 3.32

END OF SUBAREA CHANNEL FLOW HYDRAULICS:  
DEPTH(FEET) = 0.06 FLOW VELOCITY(FEET/SEC.) = 3.93  
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.30 = 603.00 FEET.

=====

END OF STUDY SUMMARY:  
TOTAL AREA(ACRES) = 2.4 TC(MIN.) = 15.12  
PEAK FLOW RATE(CFS) = 3.32  
=====

=====

END OF RATIONAL METHOD ANALYSIS

## PRE-DEVELOPMENT CONDITION

\*\*\*\*\*

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Ver. 15.0 Release Date: 04/01/2008 License ID 1452

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535 NORTH HIGHWAY 101  
SUITE A  
SOLANA BEACH CA 92705

-----  
FILE NAME: 3084EXA3.DAT

TIME/DATE OF STUDY: 09:17 05/08/2020  
-----

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:  
-----

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00

6-HOUR DURATION PRECIPITATION (INCHES) = 2.500

SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00

SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95

SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD

NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0312	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.50 FEET

as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN

OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*

\*\*\*\*\*

FLOW PROCESS FROM NODE 300.00 TO NODE 300.10 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<  
=====

\*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .4300

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 90.00

UPSTREAM ELEVATION(FEET) = 325.60

DOWNSTREAM ELEVATION(FEET) = 325.10

ELEVATION DIFFERENCE(FEET) = 0.50

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 10.601

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 52.22

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.057

SUBAREA RUNOFF(CFS) = 0.17

TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.17

\*\*\*\*\*  
FLOW PROCESS FROM NODE 300.10 TO NODE 300.20 IS CODE = 51  
-----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	325.10	DOWNSTREAM(FEET) =	320.10
CHANNEL LENGTH THRU SUBAREA(FEET) =	96.00	CHANNEL SLOPE =	0.0521
CHANNEL BASE(FEET) =	10.00	"Z" FACTOR =	50.000
MANNING'S FACTOR =	0.015	MAXIMUM DEPTH(FEET) =	1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	3.814		
*USER SPECIFIED(SUBAREA):			
USER-SPECIFIED RUNOFF COEFFICIENT =	.4300		
S.C.S. CURVE NUMBER (AMC II) =	0		
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =	0.30		
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =	1.51		
AVERAGE FLOW DEPTH(FEET) =	0.02	TRAVEL TIME(MIN.) =	1.06
Tc(MIN.) =	11.66		
SUBAREA AREA(ACRES) =	0.15	SUBAREA RUNOFF(CFS) =	0.25
AREA-AVERAGE RUNOFF COEFFICIENT =	0.430		
TOTAL AREA(ACRES) =	0.2	PEAK FLOW RATE(CFS) =	0.41

END OF SUBAREA CHANNEL FLOW HYDRAULICS:  
DEPTH(FEET) = 0.02 FLOW VELOCITY(FEET/SEC.) = 1.86  
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 300.20 = 186.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES)	=	0.2	TC(MIN.) =	11.66
PEAK FLOW RATE(CFS)	=	0.41		

=====

=====

END OF RATIONAL METHOD ANALYSIS

## PRE-DEVELOPMENT CONDITION

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
2003,1985,1981 HYDROLOGY MANUAL  
(c) Copyright 1982-2008 Advanced Engineering Software (aes)  
Ver. 15.0 Release Date: 04/01/2008 License ID 1452

Analysis prepared by:

PASCO LARET SUITER & ASSOCIATES  
535 NORTH HIGHWAY 101  
SUITE A  
SOLANA BEACH CA 92705

-----  
FILE NAME: 3084EXA4.DAT

TIME/DATE OF STUDY: 09:20 05/08/2020  
-----

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:  
-----

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00  
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95  
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD  
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH LIP HIKE (FT) (FT) (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00 0.0312 0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.50 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN  
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*

\*\*\*\*\*

FLOW PROCESS FROM NODE 400.00 TO NODE 400.10 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<  
=====

\*USER SPECIFIED(SUBAREA):

USER-SPECIFIED RUNOFF COEFFICIENT = .4300  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 75.00  
UPSTREAM ELEVATION(FEET) = 320.00  
DOWNSTREAM ELEVATION(FEET) = 318.00  
ELEVATION DIFFERENCE(FEET) = 2.00  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.532  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.057  
SUBAREA RUNOFF(CFS) = 0.22  
TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.22

\*\*\*\*\*

FLOW PROCESS FROM NODE 400.10 TO NODE 400.20 IS CODE = 51

```

-----
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 318.00 DOWNSTREAM(FEET) = 315.50
CHANNEL LENGTH THRU SUBAREA(FEET) = 418.00 CHANNEL SLOPE = 0.0060
CHANNEL BASE(FEET) = 10.00 "Z" FACTOR = 50.000
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.123
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4300
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.98
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 0.83
AVERAGE FLOW DEPTH(FEET) = 0.14 TRAVEL TIME(MIN.) = 8.37
Tc(MIN.) = 15.90
SUBAREA AREA(ACRES) = 2.54 SUBAREA RUNOFF(CFS) = 3.41
AREA-AVERAGE RUNOFF COEFFICIENT = 0.430
TOTAL AREA(ACRES) = 2.6 PEAK FLOW RATE(CFS) = 3.55

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.19 FLOW VELOCITY(FEET/SEC.) = 0.97
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 400.20 = 493.00 FEET.

*****
FLOW PROCESS FROM NODE 400.20 TO NODE 400.20 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.123
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4300
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4300
SUBAREA AREA(ACRES) = 0.86 SUBAREA RUNOFF(CFS) = 1.15
TOTAL AREA(ACRES) = 3.5 TOTAL RUNOFF(CFS) = 4.70
TC(MIN.) = 15.90

*****
FLOW PROCESS FROM NODE 400.20 TO NODE 400.30 IS CODE = 41
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 309.50 DOWNSTREAM(FEET) = 307.20
FLOW LENGTH(FEET) = 109.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 7.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.46
GIVEN PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 4.70
PIPE TRAVEL TIME(MIN.) = 0.24 Tc(MIN.) = 16.15
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 400.30 = 602.00 FEET.

=====
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 3.5 TC(MIN.) = 16.15
PEAK FLOW RATE(CFS) = 4.70
=====
END OF RATIONAL METHOD ANALYSIS

```

**AES Post-Development Output Report (Unmitigated)**

## POST-DEVELOPMENT CONDITION (UNMITIGATED)

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
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Ver. 15.0 Release Date: 04/01/2008 License ID 1452

Analysis prepared by:

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SUITE A  
SOLANA BEACH CA 92705

-----  
FILE NAME: 3084P00A.DAT

TIME/DATE OF STUDY: 10:11 05/11/2020  
-----

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:  
-----

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00  
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 4.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90  
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD  
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS  
\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*  
    HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING  
    WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR  
NO. (FT) (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (n)  
--- -----  
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0312 0.167 0.0150  
2 12.0 7.0 0.020/0.020/0.020 0.50 1.50 0.0100 0.125 0.0180

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:  
1. Relative Flow-Depth = 0.00 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)  
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)  
\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN  
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*

\*\*\*\*\*  
FLOW PROCESS FROM NODE 100.00 TO NODE 100.10 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<  
-----

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .7400  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 61.00  
UPSTREAM ELEVATION(FEET) = 320.73  
DOWNSTREAM ELEVATION(FEET) = 320.10  
ELEVATION DIFFERENCE(FEET) = 0.63  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.007  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.581  
SUBAREA RUNOFF(CFS) = 0.73  
TOTAL AREA(ACRES) = 0.15 TOTAL RUNOFF(CFS) = 0.73

\*\*\*\*\*

FLOW PROCESS FROM NODE 100.10 TO NODE 100.20 IS CODE = 62  
-----

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>(STREET TABLE SECTION # 2 USED)<<<<  
-----

UPSTREAM ELEVATION(FEET) = 320.10 DOWNSTREAM ELEVATION(FEET) = 314.97  
STREET LENGTH(FEET) = 457.00 CURB HEIGHT(INCHES) = 6.0  
STREET HALFWIDTH(FEET) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00  
INSIDE STREET CROSSFALL(DECIMAL) = 0.020  
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1  
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020  
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curb) = 0.0180  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.82  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH(FEET) = 0.33  
HALFSTREET FLOOD WIDTH(FEET) = 11.26  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.08  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 0.69  
STREET FLOW TRAVEL TIME(MIN.) = 3.66 Tc(MIN.) = 8.66  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.621  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .7400  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740  
SUBAREA AREA(ACRES) = 1.21 SUBAREA RUNOFF(CFS) = 4.14  
TOTAL AREA(ACRES) = 1.4 PEAK FLOW RATE(CFS) = 4.65

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH(FEET) = 0.35 HALFSTREET FLOOD WIDTH(FEET) = 12.00  
FLOW VELOCITY(FEET/SEC.) = 2.17 DEPTH\*VELOCITY(FT\*FT/SEC.) = 0.75  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.20 = 518.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 100.20 TO NODE 100.30 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<  
-----

ELEVATION DATA: UPSTREAM(FEET) = 312.47 DOWNSTREAM(FEET) = 311.60  
FLOW LENGTH(FEET) = 127.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 15.0 INCH PIPE IS 11.3 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.69  
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 4.65  
PIPE TRAVEL TIME(MIN.) = 0.45 Tc(MIN.) = 9.12  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.30 = 645.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 100.30 TO NODE 100.30 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<  
-----

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.472  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .7400  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7400

```

SUBAREA AREA(ACRES) = 0.34 SUBAREA RUNOFF(CFS) = 1.13
TOTAL AREA(ACRES) = 1.7 TOTAL RUNOFF(CFS) = 5.63
TC(MIN.) = 9.12
*****
FLOW PROCESS FROM NODE 100.30 TO NODE 100.30 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.472
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7317
SUBAREA AREA(ACRES) = 0.04 SUBAREA RUNOFF(CFS) = 0.06
TOTAL AREA(ACRES) = 1.7 TOTAL RUNOFF(CFS) = 5.68
TC(MIN.) = 9.12
*****
FLOW PROCESS FROM NODE 100.40 TO NODE 100.50 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 305.10 DOWNSTREAM(FEET) = 304.96
FLOW LENGTH(FEET) = 22.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.89
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 5.68
PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 9.19
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.50 = 667.00 FEET.
*****
FLOW PROCESS FROM NODE 100.50 TO NODE 100.70 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 304.96 DOWNSTREAM(FEET) = 303.40
FLOW LENGTH(FEET) = 308.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 12.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.47
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 5.68
PIPE TRAVEL TIME(MIN.) = 1.15 Tc(MIN.) = 10.34
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.70 = 975.00 FEET.
*****
FLOW PROCESS FROM NODE 100.70 TO NODE 100.70 IS CODE = 10
-----
>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
=====
*****
FLOW PROCESS FROM NODE 400.00 TO NODE 400.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00

```

```

UPSTREAM ELEVATION(FEET) = 321.03
DOWNSTREAM ELEVATION(FEET) = 320.03
ELEVATION DIFFERENCE(FEET) = 1.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.224
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 65.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.403
SUBAREA RUNOFF(CFS) = 0.47
TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.47
*****
FLOW PROCESS FROM NODE 400.10 TO NODE 400.20 IS CODE = 62
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 320.03 DOWNSTREAM ELEVATION(FEET) = 314.98
STREET LENGTH(FEET) = 438.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 12.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.18
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.34
HALFSTREET FLOOD WIDTH(FEET) = 11.75
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.17
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.74
STREET FLOW TRAVEL TIME(MIN.) = 3.37 Tc(MIN.) = 8.59
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.645
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740
SUBAREA AREA(ACRES) = 1.57 SUBAREA RUNOFF(CFS) = 5.40
TOTAL AREA(ACRES) = 1.7 PEAK FLOW RATE(CFS) = 5.74
END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.35 HALFSTREET FLOOD WIDTH(FEET) = 12.00
FLOW VELOCITY(FEET/SEC.) = 2.20 DEPTH*VELOCITY(FT*FT/SEC.) = 0.76
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 400.20 = 538.00 FEET.
*****
FLOW PROCESS FROM NODE 400.20 TO NODE 400.30 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 311.98 DOWNSTREAM(FEET) = 310.20
FLOW LENGTH(FEET) = 129.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.51
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 5.74

```

PIPE TRAVEL TIME(MIN.) = 0.33 Tc(MIN.) = 8.92  
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 400.30 = 667.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 400.30 TO NODE 400.30 IS CODE = 1  
-----

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<  
=====

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:  
TIME OF CONCENTRATION(MIN.) = 8.92  
RAINFALL INTENSITY(INCH/HR) = 4.53  
TOTAL STREAM AREA(ACRES) = 1.67  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.74

\*\*\*\*\*  
FLOW PROCESS FROM NODE 400.40 TO NODE 400.50 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<  
=====

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .7400  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 128.00  
UPSTREAM ELEVATION(FEET) = 321.74  
DOWNSTREAM ELEVATION(FEET) = 320.70  
ELEVATION DIFFERENCE(FEET) = 1.04  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.351  
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN  
THE MAXIMUM OVERLAND FLOW LENGTH = 59.37  
(Reference: Table 3-1B of Hydrology Manual)  
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.305  
SUBAREA RUNOFF(CFS) = 0.98  
TOTAL AREA(ACRES) = 0.21 TOTAL RUNOFF(CFS) = 0.98

\*\*\*\*\*  
FLOW PROCESS FROM NODE 400.50 TO NODE 400.60 IS CODE = 62  
-----

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>(STREET TABLE SECTION # 2 USED)<<<<  
=====

UPSTREAM ELEVATION(FEET) = 320.70 DOWNSTREAM ELEVATION(FEET) = 314.42  
STREET LENGTH(FEET) = 569.00 CURB HEIGHT(INCHES) = 6.0  
STREET HALFWIDTH(FEET) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00  
INSIDE STREET CROSSFALL(DECIMAL) = 0.020  
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1  
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020  
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0180  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 4.15  
\*\*\*STREET FLOW SPLITS OVER STREET-CROWN\*\*\*  
FULL DEPTH(FEET) = 0.35 FLOOD WIDTH(FEET) = 12.00  
FULL HALF-STREET VELOCITY(FEET/SEC.) = 2.15  
SPLIT DEPTH(FEET) = 0.24 SPLIT FLOOD WIDTH(FEET) = 6.78  
SPLIT FLOW(CFS) = 0.86 SPLIT VELOCITY(FEET/SEC.) = 1.58  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH(FEET) = 0.35

HALFSTREET FLOOD WIDTH(FEET) = 12.00  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.15  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 0.74  
STREET FLOW TRAVEL TIME(MIN.) = 4.41 Tc(MIN.) = 9.76  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.278  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .7400  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740  
SUBAREA AREA(ACRES) = 2.00 SUBAREA RUNOFF(CFS) = 6.33  
TOTAL AREA(ACRES) = 2.2 PEAK FLOW RATE(CFS) = 7.00

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH(FEET) = 0.35 HALFSTREET FLOOD WIDTH(FEET) = 12.00  
FLOW VELOCITY(FEET/SEC.) = 2.20 DEPTH\*VELOCITY(FT\*FT/SEC.) = 0.77  
LONGEST FLOWPATH FROM NODE 400.40 TO NODE 400.60 = 697.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 400.60 TO NODE 400.70 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<  
=====

ELEVATION DATA: UPSTREAM(FEET) = 311.42 DOWNSTREAM(FEET) = 310.20  
FLOW LENGTH(FEET) = 130.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.3 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.96  
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 7.00  
PIPE TRAVEL TIME(MIN.) = 0.36 Tc(MIN.) = 10.13  
LONGEST FLOWPATH FROM NODE 400.40 TO NODE 400.70 = 827.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 400.30 TO NODE 400.70 IS CODE = 1  
-----

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<  
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<  
=====

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
TIME OF CONCENTRATION(MIN.) = 10.13  
RAINFALL INTENSITY(INCH/HR) = 4.18  
TOTAL STREAM AREA(ACRES) = 2.21  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.00

\*\* CONFLUENCE DATA \*\*  
STREAM RUNOFF Tc INTENSITY AREA  
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)  
1 5.74 8.92 4.534 1.67  
2 7.00 10.13 4.178 2.21

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*  
STREAM RUNOFF Tc INTENSITY  
NUMBER (CFS) (MIN.) (INCH/HOUR)  
1 11.91 8.92 4.534  
2 12.29 10.13 4.178

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 12.29 Tc(MIN.) = 10.13  
TOTAL AREA(ACRES) = 3.9

```

LONGEST FLOWPATH FROM NODE    400.40 TO NODE    400.70 =    827.00 FEET.

*****
FLOW PROCESS FROM NODE    400.70 TO NODE    400.70 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.178
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7400
SUBAREA AREA(ACRES) = 0.68 SUBAREA RUNOFF(CFS) = 2.10
TOTAL AREA(ACRES) = 4.6 TOTAL RUNOFF(CFS) = 14.10
TC(MIN.) = 10.13

*****
FLOW PROCESS FROM NODE    400.70 TO NODE    400.70 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.178
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7325
SUBAREA AREA(ACRES) = 0.09 SUBAREA RUNOFF(CFS) = 0.13
TOTAL AREA(ACRES) = 4.7 TOTAL RUNOFF(CFS) = 14.23
TC(MIN.) = 10.13

*****
FLOW PROCESS FROM NODE    100.60 TO NODE    100.70 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 303.70 DOWNSTREAM(FEET) = 303.40
FLOW LENGTH(FEET) = 22.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 14.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.14
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 14.23
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 10.17
LONGEST FLOWPATH FROM NODE    400.40 TO NODE    100.70 =    849.00 FEET.

*****
FLOW PROCESS FROM NODE    100.70 TO NODE    100.70 IS CODE = 11
-----
>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<
=====

** MAIN STREAM CONFLUENCE DATA **
STREAM    RUNOFF    Tc    INTENSITY    AREA
NUMBER    (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
1    14.23    10.17    4.166    4.65
LONGEST FLOWPATH FROM NODE    400.40 TO NODE    100.70 =    849.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **
STREAM    RUNOFF    Tc    INTENSITY    AREA
NUMBER    (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
1    5.68    10.34    4.123    1.74
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    100.70 =    975.00 FEET.

```

```

** PEAK FLOW RATE TABLE **
STREAM    RUNOFF    Tc    INTENSITY
NUMBER    (CFS)    (MIN.)    (INCH/HOUR)
1    19.82    10.17    4.166
2    19.77    10.34    4.123

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 19.82 Tc(MIN.) = 10.17
TOTAL AREA(ACRES) = 6.4

*****
FLOW PROCESS FROM NODE    100.70 TO NODE    100.70 IS CODE = 12
-----
>>>>CLEAR MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE    100.70 TO NODE    100.90 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 303.40 DOWNSTREAM(FEET) = 301.92
FLOW LENGTH(FEET) = 291.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 27.0 INCH PIPE IS 20.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.01
ESTIMATED PIPE DIAMETER(INCH) = 27.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 19.82
PIPE TRAVEL TIME(MIN.) = 0.81 Tc(MIN.) = 10.98
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    100.90 =    1266.00 FEET.

*****
FLOW PROCESS FROM NODE    100.90 TO NODE    100.90 IS CODE = 10
-----
>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE    500.00 TO NODE    500.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 322.44
DOWNSTREAM ELEVATION(FEET) = 321.41
ELEVATION DIFFERENCE(FEET) = 1.03
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.185
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
        THE MAXIMUM OVERLAND FLOW LENGTH = 65.30
        (Reference: Table 3-1B of Hydrology Manual)
        THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.434
SUBAREA RUNOFF(CFS) = 0.86
TOTAL AREA(ACRES) = 0.18 TOTAL RUNOFF(CFS) = 0.86

*****
FLOW PROCESS FROM NODE    500.10 TO NODE    500.20 IS CODE = 62
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<

```

```

=====
UPSTREAM ELEVATION(FEET) = 321.41  DOWNSTREAM ELEVATION(FEET) = 314.38
STREET LENGTH(FEET) = 694.00  CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 12.00

```

```

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

```

```

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

```

```

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 4.53
***STREET FLOW SPLITS OVER STREET-CROWN***
FULL DEPTH(FEET) = 0.35  FLOOD WIDTH(FEET) = 12.00
FULL HALF-STREET VELOCITY(FEET/SEC.) = 2.06
SPLIT DEPTH(FEET) = 0.28  SPLIT FLOOD WIDTH(FEET) = 8.58
SPLIT FLOW(CFS) = 1.39  SPLIT VELOCITY(FEET/SEC.) = 1.69
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.35
HALFSTREET FLOOD WIDTH(FEET) = 12.00
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.06
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.71
STREET FLOW TRAVEL TIME(MIN.) = 5.62  Tc(MIN.) = 10.80
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.008

```

```

*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740
SUBAREA AREA(ACRES) = 2.46  SUBAREA RUNOFF(CFS) = 7.30
TOTAL AREA(ACRES) = 2.6  PEAK FLOW RATE(CFS) = 7.83

```

```

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36  HALFSTREET FLOOD WIDTH(FEET) = 12.00
FLOW VELOCITY(FEET/SEC.) = 2.25  DEPTH*VELOCITY(FT*FT/SEC.) = 0.82
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 500.20 = 794.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 500.20 TO NODE 500.30 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

```

```

ELEVATION DATA: UPSTREAM(FEET) = 311.38  DOWNSTREAM(FEET) = 310.20
FLOW LENGTH(FEET) = 120.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 12.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.21
ESTIMATED PIPE DIAMETER(INCH) = 18.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.83
PIPE TRAVEL TIME(MIN.) = 0.32  Tc(MIN.) = 11.12
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 500.30 = 914.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 500.30 TO NODE 500.30 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

```

```

=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 11.12
RAINFALL INTENSITY(INCH/HR) = 3.93

```

```

TOTAL STREAM AREA(ACRES) = 2.64
PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.83

```

```

*****
FLOW PROCESS FROM NODE 500.40 TO NODE 500.50 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

```

```

*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 142.00
UPSTREAM ELEVATION(FEET) = 321.70
DOWNSTREAM ELEVATION(FEET) = 320.32
ELEVATION DIFFERENCE(FEET) = 1.38
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.240
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 64.16
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.391
SUBAREA RUNOFF(CFS) = 0.52
TOTAL AREA(ACRES) = 0.11  TOTAL RUNOFF(CFS) = 0.52

```

```

*****
FLOW PROCESS FROM NODE 500.50 TO NODE 500.60 IS CODE = 62
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<

```

```

UPSTREAM ELEVATION(FEET) = 320.32  DOWNSTREAM ELEVATION(FEET) = 315.05
STREET LENGTH(FEET) = 449.00  CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 12.00

```

```

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

```

```

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

```

```

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.23
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.34
HALFSTREET FLOOD WIDTH(FEET) = 11.75
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.20
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.75
STREET FLOW TRAVEL TIME(MIN.) = 3.40  Tc(MIN.) = 8.64
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.629
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740
SUBAREA AREA(ACRES) = 1.58  SUBAREA RUNOFF(CFS) = 5.41
TOTAL AREA(ACRES) = 1.7  PEAK FLOW RATE(CFS) = 5.79

```

```

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.35  HALFSTREET FLOOD WIDTH(FEET) = 12.00
FLOW VELOCITY(FEET/SEC.) = 2.22  DEPTH*VELOCITY(FT*FT/SEC.) = 0.76
LONGEST FLOWPATH FROM NODE 500.40 TO NODE 500.60 = 591.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE    500.60 TO NODE    500.70 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 312.05 DOWNSTREAM(FEET) = 310.20
FLOW LENGTH(FEET) = 129.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.64
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 5.79
PIPE TRAVEL TIME(MIN.) = 0.32 Tc(MIN.) = 8.96
LONGEST FLOWPATH FROM NODE    500.40 TO NODE    500.70 = 720.00 FEET.

*****
FLOW PROCESS FROM NODE    500.30 TO NODE    500.70 IS CODE = 1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 8.96
RAINFALL INTENSITY(INCH/HR) = 4.52
TOTAL STREAM AREA(ACRES) = 1.69
PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.79

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 7.83 11.12 3.933 2.64
2 5.79 8.96 4.520 1.69

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/HOUR)
1 12.10 8.96 4.520
2 12.87 11.12 3.933

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 12.87 Tc(MIN.) = 11.12
TOTAL AREA(ACRES) = 4.3
LONGEST FLOWPATH FROM NODE    500.00 TO NODE    500.70 = 914.00 FEET.

*****
FLOW PROCESS FROM NODE    500.70 TO NODE    500.70 IS CODE = 81
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.933
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7400
SUBAREA AREA(ACRES) = 0.60 SUBAREA RUNOFF(CFS) = 1.75
TOTAL AREA(ACRES) = 4.9 TOTAL RUNOFF(CFS) = 14.35
TC(MIN.) = 11.12

*****

```

```

FLOW PROCESS FROM NODE    500.70 TO NODE    500.70 IS CODE = 81
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.933
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7322
SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.14
TOTAL AREA(ACRES) = 5.0 TOTAL RUNOFF(CFS) = 14.48
TC(MIN.) = 11.12

*****
FLOW PROCESS FROM NODE    100.80 TO NODE    100.90 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 303.70 DOWNSTREAM(FEET) = 301.92
FLOW LENGTH(FEET) = 24.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 15.34
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 14.48
PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 11.15
LONGEST FLOWPATH FROM NODE    500.00 TO NODE    100.90 = 938.00 FEET.

*****
FLOW PROCESS FROM NODE    100.90 TO NODE    100.90 IS CODE = 11
-----
>>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
=====

** MAIN STREAM CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 14.48 11.15 3.927 5.03
LONGEST FLOWPATH FROM NODE    500.00 TO NODE    100.90 = 938.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 19.82 10.98 3.966 6.39
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    100.90 = 1266.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/HOUR)
1 34.08 10.98 3.966
2 34.11 11.15 3.927

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 34.11 Tc(MIN.) = 11.15
TOTAL AREA(ACRES) = 11.4

*****
FLOW PROCESS FROM NODE    100.90 TO NODE    100.90 IS CODE = 12
-----
>>>>>CLEAR MEMORY BANK # 1 <<<<<
=====

*****

```

```

FLOW PROCESS FROM NODE    100.90 TO NODE    100.11 IS CODE =  31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =   301.92  DOWNSTREAM(FEET) =   300.94
FLOW LENGTH(FEET) =   193.00  MANNING'S N =   0.013
DEPTH OF FLOW IN 33.0 INCH PIPE IS 25.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =    6.87
ESTIMATED PIPE DIAMETER(INCH) =   33.00  NUMBER OF PIPES =    1
PIPE-FLOW(CFS) =         34.11
PIPE TRAVEL TIME(MIN.) =    0.47  Tc(MIN.) =   11.62
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    100.11 =   1459.00 FEET.

*****
FLOW PROCESS FROM NODE    100.11 TO NODE    100.11 IS CODE =  10
-----
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
=====

*****
FLOW PROCESS FROM NODE    700.00 TO NODE    700.10 IS CODE =  21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4100
S.C.S. CURVE NUMBER (AMC II) =    0
INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
UPSTREAM ELEVATION(FEET) =   322.97
DOWNSTREAM ELEVATION(FEET) =   321.47
ELEVATION DIFFERENCE(FEET) =    1.50
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.078
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY (INCH/HOUR) =   4.483
SUBAREA RUNOFF(CFS) =         0.55
TOTAL AREA(ACRES) =    0.30  TOTAL RUNOFF(CFS) =    0.55

*****
FLOW PROCESS FROM NODE    700.10 TO NODE    700.20 IS CODE =  62
-----
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION # 2 USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) =   321.47  DOWNSTREAM ELEVATION(FEET) =   315.74
STREET LENGTH(FEET) =   509.00  CURB HEIGHT(INCHES) =    6.0
STREET HALFWIDTH(FEET) =   12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =    7.00
INSIDE STREET CROSSFALL(DECIMAL) =    0.020
OUTSIDE STREET CROSSFALL(DECIMAL) =    0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =    1
STREET PARKWAY CROSSFALL(DECIMAL) =    0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    1.28
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) =    0.27

```

```

HALFSTREET FLOOD WIDTH(FEET) =    8.09
AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.73
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.46
STREET FLOW TRAVEL TIME(MIN.) =    4.90  Tc(MIN.) =   13.98
100 YEAR RAINFALL INTENSITY (INCH/HOUR) =    3.394
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4100
S.C.S. CURVE NUMBER (AMC II) =    0
AREA-AVERAGE RUNOFF COEFFICIENT =    0.410
SUBAREA AREA(ACRES) =    1.04  SUBAREA RUNOFF(CFS) =    1.45
TOTAL AREA(ACRES) =    1.3  PEAK FLOW RATE(CFS) =    1.86

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.29  HALFSTREET FLOOD WIDTH(FEET) =    9.46
FLOW VELOCITY(FEET/SEC.) =    1.90  DEPTH*VELOCITY(FT*FT/SEC.) =    0.56
LONGEST FLOWPATH FROM NODE    700.00 TO NODE    700.20 =   609.00 FEET.

*****
FLOW PROCESS FROM NODE    700.20 TO NODE    700.30 IS CODE =  31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =   313.24  DOWNSTREAM(FEET) =   311.80
FLOW LENGTH(FEET) =   118.00  MANNING'S N =   0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =    4.75
ESTIMATED PIPE DIAMETER(INCH) =   12.00  NUMBER OF PIPES =    1
PIPE-FLOW(CFS) =         1.86
PIPE TRAVEL TIME(MIN.) =    0.41  Tc(MIN.) =   14.39
LONGEST FLOWPATH FROM NODE    700.00 TO NODE    700.30 =   727.00 FEET.

*****
FLOW PROCESS FROM NODE    700.30 TO NODE    700.30 IS CODE =  81
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
100 YEAR RAINFALL INTENSITY (INCH/HOUR) =    3.331
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4100
S.C.S. CURVE NUMBER (AMC II) =    0
AREA-AVERAGE RUNOFF COEFFICIENT =    0.4100
SUBAREA AREA(ACRES) =    4.94  SUBAREA RUNOFF(CFS) =    6.75
TOTAL AREA(ACRES) =    6.3  TOTAL RUNOFF(CFS) =    8.58
Tc(MIN.) =   14.39

*****
FLOW PROCESS FROM NODE    700.30 TO NODE    700.30 IS CODE =  81
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
100 YEAR RAINFALL INTENSITY (INCH/HOUR) =    3.331
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) =    0
AREA-AVERAGE RUNOFF COEFFICIENT =    0.4096
SUBAREA AREA(ACRES) =    0.04  SUBAREA RUNOFF(CFS) =    0.05
TOTAL AREA(ACRES) =    6.3  TOTAL RUNOFF(CFS) =    8.62
Tc(MIN.) =   14.39

*****
FLOW PROCESS FROM NODE    100.10 TO NODE    100.11 IS CODE =  31
-----

```

```

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 305.30 DOWNSTREAM(FEET) = 300.94
FLOW LENGTH(FEET) = 10.50 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 6.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 25.76
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 8.62
PIPE TRAVEL TIME(MIN.) = 0.01 Tc(MIN.) = 14.40
LONGEST FLOWPATH FROM NODE 700.00 TO NODE 100.11 = 737.50 FEET.

*****
FLOW PROCESS FROM NODE 100.11 TO NODE 100.11 IS CODE = 11
-----
>>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<
=====

** MAIN STREAM CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 8.62 14.40 3.330 6.32
LONGEST FLOWPATH FROM NODE 700.00 TO NODE 100.11 = 737.50 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 34.11 11.62 3.824 11.42
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.11 = 1459.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/HOUR)
1 41.07 11.62 3.824
2 38.32 14.40 3.330

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 41.07 Tc(MIN.) = 11.62
TOTAL AREA(ACRES) = 17.7

*****
FLOW PROCESS FROM NODE 100.11 TO NODE 100.11 IS CODE = 12
-----
>>>>>CLEAR MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE 100.11 TO NODE 100.12 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 300.94 DOWNSTREAM(FEET) = 300.80
FLOW LENGTH(FEET) = 24.90 MANNING'S N = 0.013
DEPTH OF FLOW IN 36.0 INCH PIPE IS 25.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.58
ESTIMATED PIPE DIAMETER(INCH) = 36.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 41.07
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 11.67
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.12 = 1483.90 FEET.

*****
FLOW PROCESS FROM NODE 100.12 TO NODE 100.12 IS CODE = 10

```

```

-----
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE 600.00 TO NODE 600.10 IS CODE = 21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====

*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7600
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 144.00
UPSTREAM ELEVATION(FEET) = 322.44
DOWNSTREAM ELEVATION(FEET) = 320.95
ELEVATION DIFFERENCE(FEET) = 1.49
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.891
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 65.35
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.587
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) = 1.35
TOTAL AREA(ACRES) = 0.27 TOTAL RUNOFF(CFS) = 1.35

*****
FLOW PROCESS FROM NODE 600.10 TO NODE 600.20 IS CODE = 51
-----
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 320.95 DOWNSTREAM(FEET) = 317.90
CHANNEL LENGTH THRU SUBAREA(FEET) = 100.00 CHANNEL SLOPE = 0.0305
CHANNEL BASE(FEET) = 5.00 "Z" FACTOR = 10.000
MANNING'S FACTOR = 0.018 MAXIMUM DEPTH(FEET) = 1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.230
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7600
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.16
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.98
AVERAGE FLOW DEPTH(FEET) = 0.12 TRAVEL TIME(MIN.) = 0.56
Tc(MIN.) = 5.45
SUBAREA AREA(ACRES) = 0.34 SUBAREA RUNOFF(CFS) = 1.61
AREA-AVERAGE RUNOFF COEFFICIENT = 0.760
TOTAL AREA(ACRES) = 0.6 PEAK FLOW RATE(CFS) = 2.89

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.13 FLOW VELOCITY(FEET/SEC.) = 3.39
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 600.20 = 244.00 FEET.

*****
FLOW PROCESS FROM NODE 600.20 TO NODE 600.20 IS CODE = 81
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.230
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7534
SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = 0.02

```

```

TOTAL AREA(ACRES) =      0.6  TOTAL RUNOFF(CFS) =      2.91
TC(MIN.) =      5.45

*****
FLOW PROCESS FROM NODE    600.20 TO NODE    600.30 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 313.40  DOWNSTREAM(FEET) = 305.30
FLOW LENGTH(FEET) = 274.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.42
ESTIMATED PIPE DIAMETER(INCH) = 12.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.91
PIPE TRAVEL TIME(MIN.) = 0.62  Tc(MIN.) = 6.07
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 600.30 = 518.00 FEET.

*****
FLOW PROCESS FROM NODE    600.30 TO NODE    600.40 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 310.35  DOWNSTREAM(FEET) = 307.69
FLOW LENGTH(FEET) = 266.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 8.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.85
ESTIMATED PIPE DIAMETER(INCH) = 12.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.91
PIPE TRAVEL TIME(MIN.) = 0.91  Tc(MIN.) = 6.98
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 600.40 = 784.00 FEET.

*****
FLOW PROCESS FROM NODE    600.40 TO NODE    100.12 IS CODE = 11
-----
>>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
=====

** MAIN STREAM CONFLUENCE DATA **
STREAM  RUNOFF  Tc  INTENSITY  AREA
NUMBER  (CFS)  (MIN.)  (INCH/ HOUR)  (ACRE)
1        2.91   6.98    5.312    0.62
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 100.12 = 784.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **
STREAM  RUNOFF  Tc  INTENSITY  AREA
NUMBER  (CFS)  (MIN.)  (INCH/ HOUR)  (ACRE)
1        41.07  11.67   3.812   17.74
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.12 = 1483.90 FEET.

** PEAK FLOW RATE TABLE **
STREAM  RUNOFF  Tc  INTENSITY
NUMBER  (CFS)  (MIN.)  (INCH/ HOUR)
1        27.47   6.98    5.312
2        43.16  11.67   3.812

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 43.16  Tc(MIN.) = 11.67
TOTAL AREA(ACRES) = 18.4

*****
FLOW PROCESS FROM NODE    100.12 TO NODE    100.12 IS CODE = 12

```

```

-----
>>>>>CLEAR MEMORY BANK # 1 <<<<<
=====

*****
FLOW PROCESS FROM NODE    100.13 TO NODE    100.14 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 297.80  DOWNSTREAM(FEET) = 293.86
FLOW LENGTH(FEET) = 184.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 30.0 INCH PIPE IS 19.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 12.78
ESTIMATED PIPE DIAMETER(INCH) = 30.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 43.16
PIPE TRAVEL TIME(MIN.) = 0.24  Tc(MIN.) = 11.91
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.14 = 1667.90 FEET.

*****
FLOW PROCESS FROM NODE    100.14 TO NODE    100.15 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 293.86  DOWNSTREAM(FEET) = 290.67
FLOW LENGTH(FEET) = 53.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 16.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 18.73
ESTIMATED PIPE DIAMETER(INCH) = 24.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 43.16
PIPE TRAVEL TIME(MIN.) = 0.05  Tc(MIN.) = 11.96
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.15 = 1720.90 FEET.

*****
FLOW PROCESS FROM NODE    100.15 TO NODE    100.16 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 290.67  DOWNSTREAM(FEET) = 289.20
FLOW LENGTH(FEET) = 25.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 16.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 18.56
ESTIMATED PIPE DIAMETER(INCH) = 24.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 43.16
PIPE TRAVEL TIME(MIN.) = 0.02  Tc(MIN.) = 11.98
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.16 = 1745.90 FEET.
=====
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 18.4  TC(MIN.) = 11.98
PEAK FLOW RATE(CFS) = 43.16
=====
END OF RATIONAL METHOD ANALYSIS

```

## POST-DEVELOPMENT CONDITION (UNMITIGATED)

```
*****
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
          2003,1985,1981 HYDROLOGY MANUAL
(c) Copyright 1982-2016 Advanced Engineering Software (aes)
Ver. 23.0 Release Date: 07/01/2016 License ID 1452

Analysis prepared by:

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SOLANA BEACH, CA 92075
858-259-8212

***** DESCRIPTION OF STUDY *****
* 3084 Fox Point *
* Proposed Condition *
* 100-yr *
*****
FILE NAME: 3084P00B.DAT
TIME/DATE OF STUDY: 11:33 07/22/2020
-----
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-----
2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT (YEAR) = 100.00
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500
SPECIFIED MINIMUM PIPE SIZE (INCH) = 4.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
  HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING
  WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)
=====
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0313 0.167 0.0150
2 12.0 7.0 0.020/0.020/0.020 0.50 1.50 0.0100 0.125 0.0180

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
   as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*****
FLOW PROCESS FROM NODE 200.00 TO NODE 200.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH (FEET) = 124.00
UPSTREAM ELEVATION (FEET) = 319.55
DOWNSTREAM ELEVATION (FEET) = 318.90
ELEVATION DIFFERENCE (FEET) = 0.65
SUBAREA OVERLAND TIME OF FLOW (MIN.) = 7.155
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH = 50.73
```

```
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 5.228
SUBAREA RUNOFF (CFS) = 1.46
TOTAL AREA (ACRES) = 0.43 TOTAL RUNOFF (CFS) = 1.46

*****
FLOW PROCESS FROM NODE 200.10 TO NODE 200.10 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 5.228
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.6432
SUBAREA AREA (ACRES) = 0.01 SUBAREA RUNOFF (CFS) = 0.02
TOTAL AREA (ACRES) = 0.4 TOTAL RUNOFF (CFS) = 1.48
Tc (MIN.) = 7.15

*****
FLOW PROCESS FROM NODE 200.10 TO NODE 200.20 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM (FEET) = 311.60 DOWNSTREAM (FEET) = 311.24
FLOW LENGTH (FEET) = 24.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.9 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 4.80
ESTIMATED PIPE DIAMETER (INCH) = 9.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 1.48
PIPE TRAVEL TIME (MIN.) = 0.08 Tc (MIN.) = 7.24
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.20 = 148.00 FEET.

*****
FLOW PROCESS FROM NODE 200.20 TO NODE 200.30 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM (FEET) = 311.24 DOWNSTREAM (FEET) = 308.38
FLOW LENGTH (FEET) = 191.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.9 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 4.80
ESTIMATED PIPE DIAMETER (INCH) = 9.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 1.48
PIPE TRAVEL TIME (MIN.) = 0.66 Tc (MIN.) = 7.90
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.30 = 339.00 FEET.

*****
FLOW PROCESS FROM NODE 200.30 TO NODE 200.40 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM (FEET) = 308.38 DOWNSTREAM (FEET) = 307.66
FLOW LENGTH (FEET) = 48.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.9 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 4.80
ESTIMATED PIPE DIAMETER (INCH) = 9.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 1.48
PIPE TRAVEL TIME (MIN.) = 0.17 Tc (MIN.) = 8.07
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.40 = 387.00 FEET.
```

```

*****
FLOW PROCESS FROM NODE    200.40 TO NODE    200.40 IS CODE =   1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====
TOTAL NUMBER OF STREAMS =   2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM   1 ARE:
TIME OF CONCENTRATION(MIN.) =   8.07
RAINFALL INTENSITY(INCH/HR) =   4.84
TOTAL STREAM AREA(ACRES) =   0.44
PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.48

*****
FLOW PROCESS FROM NODE    300.00 TO NODE    300.10 IS CODE =  21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =  100.00
UPSTREAM ELEVATION(FEET) =   320.02
DOWNSTREAM ELEVATION(FEET) =   319.02
ELEVATION DIFFERENCE(FEET) =     1.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =   6.530
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   65.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
          100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.545
SUBAREA RUNOFF(CFS) =     0.61
TOTAL AREA(ACRES) =     0.17   TOTAL RUNOFF(CFS) =     0.61

*****
FLOW PROCESS FROM NODE    300.10 TO NODE    300.20 IS CODE =  51
-----
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =   319.02  DOWNSTREAM(FEET) =   318.50
CHANNEL LENGTH THRU SUBAREA(FEET) =  136.00  CHANNEL SLOPE =  0.0038
CHANNEL BASE(FEET) =   5.00  "Z" FACTOR =   1.250
MANNING'S FACTOR = 0.015  MAXIMUM DEPTH(FEET) =   2.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.903
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) =   0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.27
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.65
AVERAGE FLOW DEPTH(FEET) =   0.15  TRAVEL TIME(MIN.) =   1.37
Tc(MIN.) =     7.90
SUBAREA AREA(ACRES) =     0.41   SUBAREA RUNOFF(CFS) =     1.31
AREA-AVERAGE RUNOFF COEFFICIENT =   0.650
TOTAL AREA(ACRES) =     0.6   PEAK FLOW RATE(CFS) =     1.85

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =   0.19  FLOW VELOCITY(FEET/SEC.) =   1.90
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    300.20 =   236.00 FEET.

*****
FLOW PROCESS FROM NODE    300.20 TO NODE    300.20 IS CODE =   81
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =   4.903

```

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```

*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.6449
SUBAREA AREA(ACRES) =     0.01   SUBAREA RUNOFF(CFS) =     0.02
TOTAL AREA(ACRES) =     0.6   TOTAL RUNOFF(CFS) =     1.87
Tc(MIN.) =     7.90

*****
FLOW PROCESS FROM NODE    300.20 TO NODE    200.40 IS CODE =  31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =   313.80  DOWNSTREAM(FEET) =   307.66
FLOW LENGTH(FEET) =   12.00  MANNING'S N =   0.013
DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   19.29
ESTIMATED PIPE DIAMETER(INCH) =   6.00   NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     1.87
PIPE TRAVEL TIME(MIN.) =     0.01   Tc(MIN.) =     7.91
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    200.40 =   248.00 FEET.

*****
FLOW PROCESS FROM NODE    200.40 TO NODE    200.40 IS CODE =   1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
=====
TOTAL NUMBER OF STREAMS =   2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM   2 ARE:
TIME OF CONCENTRATION(MIN.) =     7.91
RAINFALL INTENSITY(INCH/HR) =     4.90
TOTAL STREAM AREA(ACRES) =     0.59
PEAK FLOW RATE(CFS) AT CONFLUENCE =     1.87

** CONFLUENCE DATA **
STREAM  RUNOFF      Tc      INTENSITY      AREA
NUMBER  (CFS)      (MIN.)  (INCH/HR)  (ACRE)
   1     1.48      8.07      4.838      0.44
   2     1.87      7.91      4.899      0.59

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM  RUNOFF      Tc      INTENSITY
NUMBER  (CFS)      (MIN.)  (INCH/HR)
   1     3.32      7.91      4.899
   2     3.32      8.07      4.838

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     3.32   Tc(MIN.) =     8.07
TOTAL AREA(ACRES) =     1.0
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    200.40 =   387.00 FEET.

*****
FLOW PROCESS FROM NODE    200.40 TO NODE    200.50 IS CODE =  31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =   307.66  DOWNSTREAM(FEET) =   307.20
FLOW LENGTH(FEET) =   16.00  MANNING'S N =   0.013
DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.6 INCHES

```

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PIPE-FLOW VELOCITY(Feet/sec.) = 7.57
ESTIMATED PIPE DIAMETER(INCH) = 12.00    NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.32
PIPE TRAVEL TIME(MIN.) = 0.04    Tc(MIN.) = 8.10
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.50 = 403.00 FEET.
=====
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 1.0    Tc(MIN.) = 8.10
PEAK FLOW RATE(CFS) = 3.32
=====
END OF RATIONAL METHOD ANALYSIS

```

**AES Post-Development Output Report (Mitigated)**

## POST-DEVELOPMENT CONDITION (MITIGATED)

```
*****
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
          2003,1985,1981 HYDROLOGY MANUAL
(c) Copyright 1982-2016 Advanced Engineering Software (aes)
   Ver. 23.0 Release Date: 07/01/2016   License ID 1452

      Analysis prepared by:

      PASCO LARET SUITER & ASSOCIATES
      535 NORTH HIGHWAY 101, STE A
      SOLANA BEACH, CA 92075
      858-259-8212

***** DESCRIPTION OF STUDY *****
* 3084 Fox Point *
* Proposed Condition   Detained *
* 100-yr *
*****
FILE NAME: 3084PDA.DAT
TIME/DATE OF STUDY: 14:56 07/22/2020
-----
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-----
2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT (YEAR) = 100.00
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500
SPECIFIED MINIMUM PIPE SIZE (INCH) = 4.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
  HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING
  NO.  WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR
  ==  (FT)  (FT)  SIDE / SIDE/ WAY  (FT)  (FT)  (FT)  (FT)  (n)
=====
1  30.0   20.0   0.018/0.018/0.020   0.67   2.00  0.0313  0.167  0.0150
2  12.0    7.0   0.020/0.020/0.020   0.50   1.50  0.0100  0.125  0.0180

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
   as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*****
FLOW PROCESS FROM NODE 100.00 TO NODE 100.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED (SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH (FEET) = 61.00
UPSTREAM ELEVATION (FEET) = 320.73
DOWNSTREAM ELEVATION (FEET) = 320.10
ELEVATION DIFFERENCE (FEET) = 0.63
SUBAREA OVERLAND TIME OF FLOW (MIN.) = 5.007
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 6.581
SUBAREA RUNOFF (CFS) = 0.73
```

1

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TOTAL AREA (ACRES) = 0.15 TOTAL RUNOFF (CFS) = 0.73

*****
FLOW PROCESS FROM NODE 100.10 TO NODE 100.20 IS CODE = 62
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<
=====
UPSTREAM ELEVATION (FEET) = 320.10 DOWNSTREAM ELEVATION (FEET) = 314.97
STREET LENGTH (FEET) = 457.00 CURB HEIGHT (INCHES) = 6.0
STREET HALFWIDTH (FEET) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 7.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 2.82
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.33
HALFSTREET FLOOD WIDTH (FEET) = 11.26
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.08
PRODUCT OF DEPTH&VELOCITY (FT*FT/SEC.) = 0.69
STREET FLOW TRAVEL TIME (MIN.) = 3.66 Tc (MIN.) = 8.66
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.621
*USER SPECIFIED (SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740
SUBAREA AREA (ACRES) = 1.21 SUBAREA RUNOFF (CFS) = 4.14
TOTAL AREA (ACRES) = 1.4 PEAK FLOW RATE (CFS) = 4.65

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.35 HALFSTREET FLOOD WIDTH (FEET) = 12.00
FLOW VELOCITY (FEET/SEC.) = 2.17 DEPTH*VELOCITY (FT*FT/SEC.) = 0.75
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.20 = 518.00 FEET.

*****
FLOW PROCESS FROM NODE 100.20 TO NODE 100.30 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM (FEET) = 312.47 DOWNSTREAM (FEET) = 311.60
FLOW LENGTH (FEET) = 127.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 11.3 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 4.69
ESTIMATED PIPE DIAMETER (INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 4.65
PIPE TRAVEL TIME (MIN.) = 0.45 Tc (MIN.) = 9.12
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.30 = 645.00 FEET.

*****
FLOW PROCESS FROM NODE 100.30 TO NODE 100.30 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 4.472
*USER SPECIFIED (SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
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AREA-AVERAGE RUNOFF COEFFICIENT = 0.7400
SUBAREA AREA(ACRES) = 0.34 SUBAREA RUNOFF(CFS) = 1.13
TOTAL AREA(ACRES) = 1.7 TOTAL RUNOFF(CFS) = 5.63
TC(MIN.) = 9.12

*****
FLOW PROCESS FROM NODE 100.30 TO NODE 100.30 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.472
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7317
SUBAREA AREA(ACRES) = 0.04 SUBAREA RUNOFF(CFS) = 0.06
TOTAL AREA(ACRES) = 1.7 TOTAL RUNOFF(CFS) = 5.68
TC(MIN.) = 9.12

*****
FLOW PROCESS FROM NODE 100.40 TO NODE 100.40 IS CODE = 7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 13.92 RAIN INTENSITY(INCH/HOUR) = 3.40
TOTAL AREA(ACRES) = 1.70 TOTAL RUNOFF(CFS) = 0.75

*****
FLOW PROCESS FROM NODE 100.40 TO NODE 100.50 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 305.10 DOWNSTREAM(FEET) = 304.96
FLOW LENGTH(FEET) = 22.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 2.95
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 0.75
PIPE TRAVEL TIME(MIN.) = 0.12 Tc(MIN.) = 14.04
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.50 = 667.00 FEET.

*****
FLOW PROCESS FROM NODE 100.50 TO NODE 100.70 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 304.96 DOWNSTREAM(FEET) = 303.40
FLOW LENGTH(FEET) = 308.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 2.72
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 0.75
PIPE TRAVEL TIME(MIN.) = 1.89 Tc(MIN.) = 15.93
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.70 = 975.00 FEET.

*****
FLOW PROCESS FROM NODE 100.70 TO NODE 100.70 IS CODE = 10
-----
>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
=====
*****

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FLOW PROCESS FROM NODE 400.00 TO NODE 400.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 321.03
DOWNSTREAM ELEVATION(FEET) = 320.03
ELEVATION DIFFERENCE(FEET) = 1.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.224
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH = 65.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.403
SUBAREA RUNOFF(CFS) = 0.47
TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.47

*****
FLOW PROCESS FROM NODE 400.10 TO NODE 400.20 IS CODE = 62
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 320.03 DOWNSTREAM ELEVATION(FEET) = 314.98
STREET LENGTH(FEET) = 438.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.18
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.34
HALFSTREET FLOOD WIDTH(FEET) = 11.75
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.17
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.74
STREET FLOW TRAVEL TIME(MIN.) = 3.37 Tc(MIN.) = 8.59
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.645
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740
SUBAREA AREA(ACRES) = 1.57 SUBAREA RUNOFF(CFS) = 5.40
TOTAL AREA(ACRES) = 1.7 PEAK FLOW RATE(CFS) = 5.74

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.35 HALFSTREET FLOOD WIDTH(FEET) = 12.00
FLOW VELOCITY(FEET/SEC.) = 2.20 DEPTH*VELOCITY(FT*FT/SEC.) = 0.76
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 400.20 = 538.00 FEET.

*****
FLOW PROCESS FROM NODE 400.20 TO NODE 400.30 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====

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ELEVATION DATA: UPSTREAM( FEET ) = 311.98 DOWNSTREAM( FEET ) = 310.20
FLOW LENGTH( FEET ) = 129.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.1 INCHES
PIPE-FLOW VELOCITY( FEET/SEC. ) = 6.51
ESTIMATED PIPE DIAMETER( INCH ) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW( CFS ) = 5.74
PIPE TRAVEL TIME( MIN. ) = 0.33 Tc( MIN. ) = 8.92
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 400.30 = 667.00 FEET.

*****
FLOW PROCESS FROM NODE 400.30 TO NODE 400.30 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION( MIN. ) = 8.92
RAINFALL INTENSITY( INCH/HR ) = 4.53
TOTAL STREAM AREA( ACRES ) = 1.67
PEAK FLOW RATE( CFS ) AT CONFLUENCE = 5.74

*****
FLOW PROCESS FROM NODE 400.40 TO NODE 400.50 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED( SUBAREA ) :
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER ( AMC II ) = 0
INITIAL SUBAREA FLOW-LENGTH( FEET ) = 128.00
UPSTREAM ELEVATION( FEET ) = 321.74
DOWNSTREAM ELEVATION( FEET ) = 320.70
ELEVATION DIFFERENCE( FEET ) = 1.04
SUBAREA OVERLAND TIME OF FLOW( MIN. ) = 5.351
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 59.37
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY( INCH/HOUR ) = 6.305
SUBAREA RUNOFF( CFS ) = 0.98
TOTAL AREA( ACRES ) = 0.21 TOTAL RUNOFF( CFS ) = 0.98

*****
FLOW PROCESS FROM NODE 400.50 TO NODE 400.60 IS CODE = 62
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>( STREET TABLE SECTION # 2 USED )<<<<
=====
UPSTREAM ELEVATION( FEET ) = 320.70 DOWNSTREAM ELEVATION( FEET ) = 314.42
STREET LENGTH( FEET ) = 569.00 CURB HEIGHT( INCHES ) = 6.0
STREET HALFWIDTH( FEET ) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK( FEET ) = 7.00
INSIDE STREET CROSSFALL( DECIMAL ) = 0.020
OUTSIDE STREET CROSSFALL( DECIMAL ) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL( DECIMAL ) = 0.020
Manning's FRICTION FACTOR for Streetflow Section( curb-to-curb ) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW( CFS ) = 4.15
***STREET FLOW SPLITS OVER STREET-CROWN***
FULL DEPTH( FEET ) = 0.35 FLOOD WIDTH( FEET ) = 12.00
FULL HALF-STREET VELOCITY( FEET/SEC. ) = 2.15

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SPLIT DEPTH( FEET ) = 0.24 SPLIT FLOOD WIDTH( FEET ) = 6.78
SPLIT FLOW( CFS ) = 0.86 SPLIT VELOCITY( FEET/SEC. ) = 1.58
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH( FEET ) = 0.35
HALFSTREET FLOOD WIDTH( FEET ) = 12.00
AVERAGE FLOW VELOCITY( FEET/SEC. ) = 2.15
PRODUCT OF DEPTH&VELOCITY( FT*FT/SEC. ) = 0.74
STREET FLOW TRAVEL TIME( MIN. ) = 4.41 Tc( MIN. ) = 9.76
100 YEAR RAINFALL INTENSITY( INCH/HOUR ) = 4.278
*USER SPECIFIED( SUBAREA ) :
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER ( AMC II ) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740
SUBAREA AREA( ACRES ) = 2.00 SUBAREA RUNOFF( CFS ) = 6.33
TOTAL AREA( ACRES ) = 2.2 PEAK FLOW RATE( CFS ) = 7.00

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH( FEET ) = 0.35 HALFSTREET FLOOD WIDTH( FEET ) = 12.00
FLOW VELOCITY( FEET/SEC. ) = 2.20 DEPTH*VELOCITY( FT*FT/SEC. ) = 0.77
LONGEST FLOWPATH FROM NODE 400.40 TO NODE 400.60 = 697.00 FEET.

*****
FLOW PROCESS FROM NODE 400.60 TO NODE 400.70 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE ( NON-PRESSURE FLOW )<<<<
=====
ELEVATION DATA: UPSTREAM( FEET ) = 311.42 DOWNSTREAM( FEET ) = 310.20
FLOW LENGTH( FEET ) = 130.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.3 INCHES
PIPE-FLOW VELOCITY( FEET/SEC. ) = 5.96
ESTIMATED PIPE DIAMETER( INCH ) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW( CFS ) = 7.00
PIPE TRAVEL TIME( MIN. ) = 0.36 Tc( MIN. ) = 10.13
LONGEST FLOWPATH FROM NODE 400.40 TO NODE 400.70 = 827.00 FEET.

*****
FLOW PROCESS FROM NODE 400.30 TO NODE 400.70 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION( MIN. ) = 10.13
RAINFALL INTENSITY( INCH/HR ) = 4.18
TOTAL STREAM AREA( ACRES ) = 2.21
PEAK FLOW RATE( CFS ) AT CONFLUENCE = 7.00

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER ( CFS ) ( MIN. ) ( INCH/HOUR ) ( ACRE )
1 5.74 8.92 4.534 1.67
2 7.00 10.13 4.178 2.21

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER ( CFS ) ( MIN. ) ( INCH/HOUR )
1 11.91 8.92 4.534
2 12.29 10.13 4.178

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

```

6

```

PEAK FLOW RATE(CFS) =      12.29   Tc(MIN.) =    10.13
TOTAL AREA(ACRES) =      3.9
LONGEST FLOWPATH FROM NODE    400.40 TO NODE    400.70 =      827.00 FEET.

*****
FLOW PROCESS FROM NODE    400.70 TO NODE    400.70 IS CODE =   81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.178
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7400
SUBAREA AREA(ACRES) = 0.68   SUBAREA RUNOFF(CFS) = 2.10
TOTAL AREA(ACRES) = 4.6     TOTAL RUNOFF(CFS) = 14.10
TC(MIN.) = 10.13

*****
FLOW PROCESS FROM NODE    400.70 TO NODE    400.70 IS CODE =   81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.178
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7325
SUBAREA AREA(ACRES) = 0.09   SUBAREA RUNOFF(CFS) = 0.13
TOTAL AREA(ACRES) = 4.7     TOTAL RUNOFF(CFS) = 14.23
TC(MIN.) = 10.13

*****
FLOW PROCESS FROM NODE    100.60 TO NODE    100.60 IS CODE =    7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 19.53   RAIN INTENSITY(INCH/HOUR) = 2.74
TOTAL AREA(ACRES) = 4.70   TOTAL RUNOFF(CFS) = 0.96

*****
FLOW PROCESS FROM NODE    100.60 TO NODE    100.70 IS CODE =   31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 303.70   DOWNSTREAM(FEET) = 303.40
FLOW LENGTH(FEET) = 22.00   MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 4.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.21
ESTIMATED PIPE DIAMETER(INCH) = 9.00   NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 0.96
PIPE TRAVEL TIME(MIN.) = 0.09   Tc(MIN.) = 19.62
LONGEST FLOWPATH FROM NODE    400.40 TO NODE    100.70 =      849.00 FEET.

*****
FLOW PROCESS FROM NODE    100.70 TO NODE    100.70 IS CODE =   11
-----
>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<
=====

** MAIN STREAM CONFLUENCE DATA **
STREAM   RUNOFF   Tc   INTENSITY   AREA
NUMBER   (CFS)   (MIN.) (INCH/HOUR) (ACRE)

```

```

1      0.96   19.62      2.727      4.70
LONGEST FLOWPATH FROM NODE    400.40 TO NODE    100.70 =      849.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **
STREAM   RUNOFF   Tc   INTENSITY   AREA
NUMBER   (CFS)   (MIN.) (INCH/HOUR) (ACRE)
1      0.75   15.93      3.119      1.70
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    100.70 =      975.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM   RUNOFF   Tc   INTENSITY
NUMBER   (CFS)   (MIN.) (INCH/HOUR)
1      1.53   15.93      3.119
2      1.62   19.62      2.727

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 1.62   Tc(MIN.) = 19.62
TOTAL AREA(ACRES) = 6.4

*****
FLOW PROCESS FROM NODE    100.70 TO NODE    100.70 IS CODE =   12
-----
>>>>CLEAR MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE    100.70 TO NODE    100.90 IS CODE =   31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 303.40   DOWNSTREAM(FEET) = 301.92
FLOW LENGTH(FEET) = 291.00   MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 7.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 3.29
ESTIMATED PIPE DIAMETER(INCH) = 12.00   NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.62
PIPE TRAVEL TIME(MIN.) = 1.47   Tc(MIN.) = 21.09
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    100.90 =      1266.00 FEET.

*****
FLOW PROCESS FROM NODE    100.90 TO NODE    100.90 IS CODE =   10
-----
>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE    500.00 TO NODE    500.10 IS CODE =   21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 322.44
DOWNSTREAM ELEVATION(FEET) = 321.41
ELEVATION DIFFERENCE(FEET) = 1.03
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.185
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 65.30
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.434
SUBAREA RUNOFF(CFS) = 0.86

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TOTAL AREA(ACRES) =      0.18  TOTAL RUNOFF(CFS) =      0.86

*****
FLOW PROCESS FROM NODE      500.10 TO NODE      500.20 IS CODE = 62
-----
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION # 2 USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 321.41  DOWNSTREAM ELEVATION(FEET) = 314.38
STREET LENGTH(FEET) = 694.00  CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.53
***STREET FLOW SPLITS OVER STREET-CROWN***
FULL DEPTH(FEET) = 0.35  FLOOD WIDTH(FEET) = 12.00
FULL HALF-STREET VELOCITY(FEET/SEC.) = 2.06
SPLIT DEPTH(FEET) = 0.28  SPLIT FLOOD WIDTH(FEET) = 8.58
SPLIT FLOW(CFS) = 1.39  SPLIT VELOCITY(FEET/SEC.) = 1.69
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.35
HALFSTREET FLOOD WIDTH(FEET) = 12.00
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.06
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.71
STREET FLOW TRAVEL TIME(MIN.) = 5.62  Tc(MIN.) = 10.80
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.008
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740
SUBAREA AREA(ACRES) = 2.46  SUBAREA RUNOFF(CFS) = 7.30
TOTAL AREA(ACRES) = 2.6  PEAK FLOW RATE(CFS) = 7.83

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36  HALFSTREET FLOOD WIDTH(FEET) = 12.00
FLOW VELOCITY(FEET/SEC.) = 2.25  DEPTH*VELOCITY(FT*FT/SEC.) = 0.82
LONGEST FLOWPATH FROM NODE      500.00 TO NODE      500.20 = 794.00 FEET.

*****
FLOW PROCESS FROM NODE      500.20 TO NODE      500.30 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 311.38  DOWNSTREAM(FEET) = 310.20
FLOW LENGTH(FEET) = 120.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 12.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.21
ESTIMATED PIPE DIAMETER(INCH) = 18.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.83
PIPE TRAVEL TIME(MIN.) = 0.32  Tc(MIN.) = 11.12
LONGEST FLOWPATH FROM NODE      500.00 TO NODE      500.30 = 914.00 FEET.

*****
FLOW PROCESS FROM NODE      500.30 TO NODE      500.30 IS CODE = 1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

```

```

=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 11.12
RAINFALL INTENSITY(INCH/HR) = 3.93
TOTAL STREAM AREA(ACRES) = 2.64
PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.83

*****
FLOW PROCESS FROM NODE      500.40 TO NODE      500.50 IS CODE = 21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 142.00
UPSTREAM ELEVATION(FEET) = 321.70
DOWNSTREAM ELEVATION(FEET) = 320.32
ELEVATION DIFFERENCE(FEET) = 1.38
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.240
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH = 64.16
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.391
SUBAREA RUNOFF(CFS) = 0.52
TOTAL AREA(ACRES) = 0.11  TOTAL RUNOFF(CFS) = 0.52

*****
FLOW PROCESS FROM NODE      500.50 TO NODE      500.60 IS CODE = 62
-----
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION # 2 USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 320.32  DOWNSTREAM ELEVATION(FEET) = 315.05
STREET LENGTH(FEET) = 449.00  CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.23
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.34
HALFSTREET FLOOD WIDTH(FEET) = 11.75
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.20
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.75
STREET FLOW TRAVEL TIME(MIN.) = 3.40  Tc(MIN.) = 8.64
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.629
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7400
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.740
SUBAREA AREA(ACRES) = 1.58  SUBAREA RUNOFF(CFS) = 5.41
TOTAL AREA(ACRES) = 1.7  PEAK FLOW RATE(CFS) = 5.79

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.35  HALFSTREET FLOOD WIDTH(FEET) = 12.00

```

FLOW VELOCITY(FEET/SEC.) = 2.22 DEPTH\*VELOCITY(FT\*FT/SEC.) = 0.76  
LONGEST FLOWPATH FROM NODE 500.40 TO NODE 500.60 = 591.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 500.60 TO NODE 500.70 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<  
-----

ELEVATION DATA: UPSTREAM(FEET) = 312.05 DOWNSTREAM(FEET) = 310.20  
FLOW LENGTH(FEET) = 129.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.0 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.64  
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 5.79  
PIPE TRAVEL TIME(MIN.) = 0.32 Tc(MIN.) = 8.96  
LONGEST FLOWPATH FROM NODE 500.40 TO NODE 500.70 = 720.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 500.30 TO NODE 500.70 IS CODE = 1  
-----

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<  
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<  
-----

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
TIME OF CONCENTRATION(MIN.) = 8.96  
RAINFALL INTENSITY(INCH/HR) = 4.52  
TOTAL STREAM AREA(ACRES) = 1.69  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.79

\*\* CONFLUENCE DATA \*\*  
STREAM RUNOFF Tc INTENSITY AREA  
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)  
1 7.83 11.12 3.933 2.64  
2 5.79 8.96 4.520 1.69

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*  
STREAM RUNOFF Tc INTENSITY  
NUMBER (CFS) (MIN.) (INCH/HOUR)  
1 12.10 8.96 4.520  
2 12.87 11.12 3.933

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 12.87 Tc(MIN.) = 11.12  
TOTAL AREA(ACRES) = 4.3  
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 500.70 = 914.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 500.70 TO NODE 500.70 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<  
-----

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.933  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .7400  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7400  
SUBAREA AREA(ACRES) = 0.60 SUBAREA RUNOFF(CFS) = 1.75  
TOTAL AREA(ACRES) = 4.9 TOTAL RUNOFF(CFS) = 14.35  
Tc(MIN.) = 11.12

\*\*\*\*\*  
FLOW PROCESS FROM NODE 500.70 TO NODE 500.70 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<  
-----

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.933  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7322  
SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.14  
TOTAL AREA(ACRES) = 5.0 TOTAL RUNOFF(CFS) = 14.48  
Tc(MIN.) = 11.12

\*\*\*\*\*  
FLOW PROCESS FROM NODE 100.80 TO NODE 100.80 IS CODE = 7  
-----

>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<  
-----

USER-SPECIFIED VALUES ARE AS FOLLOWS:  
Tc(MIN) = 21.92 RAIN INTENSITY(INCH/HOUR) = 2.54  
TOTAL AREA(ACRES) = 5.03 TOTAL RUNOFF(CFS) = 0.90

\*\*\*\*\*  
FLOW PROCESS FROM NODE 100.80 TO NODE 100.90 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<  
-----

ELEVATION DATA: UPSTREAM(FEET) = 303.70 DOWNSTREAM(FEET) = 301.92  
FLOW LENGTH(FEET) = 24.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 6.0 INCH PIPE IS 3.4 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.82  
ESTIMATED PIPE DIAMETER(INCH) = 6.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 0.90  
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 21.97  
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 100.90 = 938.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 100.90 TO NODE 100.90 IS CODE = 11  
-----

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<  
-----

\*\* MAIN STREAM CONFLUENCE DATA \*\*  
STREAM RUNOFF Tc INTENSITY AREA  
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)  
1 0.90 21.97 2.535 5.03  
LONGEST FLOWPATH FROM NODE 500.00 TO NODE 100.90 = 938.00 FEET.

\*\* MEMORY BANK # 1 CONFLUENCE DATA \*\*  
STREAM RUNOFF Tc INTENSITY AREA  
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)  
1 1.62 21.09 2.603 6.40  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.90 = 1266.00 FEET.

\*\* PEAK FLOW RATE TABLE \*\*  
STREAM RUNOFF Tc INTENSITY  
NUMBER (CFS) (MIN.) (INCH/HOUR)  
1 2.48 21.09 2.603  
2 2.47 21.97 2.535

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 2.48 Tc(MIN.) = 21.09  
TOTAL AREA(ACRES) = 11.4

```

*****
FLOW PROCESS FROM NODE      100.90 TO NODE      100.90 IS CODE = 12
-----
>>>>>CLEAR MEMORY BANK # 1 <<<<<
=====
*****
FLOW PROCESS FROM NODE      100.90 TO NODE      100.11 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 301.92 DOWNSTREAM(FEET) = 300.94
FLOW LENGTH(FEET) = 193.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 8.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 3.67
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.48
PIPE TRAVEL TIME(MIN.) = 0.88 Tc(MIN.) = 21.97
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.11 = 1459.00 FEET.
*****
FLOW PROCESS FROM NODE      100.11 TO NODE      100.11 IS CODE = 10
-----
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
=====
*****
FLOW PROCESS FROM NODE      700.00 TO NODE      700.10 IS CODE = 21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4100
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 322.97
DOWNSTREAM ELEVATION(FEET) = 321.47
ELEVATION DIFFERENCE(FEET) = 1.50
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 9.078
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 70.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.483
SUBAREA RUNOFF(CFS) = 0.55
TOTAL AREA(ACRES) = 0.30 TOTAL RUNOFF(CFS) = 0.55
*****
FLOW PROCESS FROM NODE      700.10 TO NODE      700.20 IS CODE = 62
-----
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION # 2 USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 321.47 DOWNSTREAM ELEVATION(FEET) = 315.74
STREET LENGTH(FEET) = 509.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020

```

Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0180  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

```

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.28
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.27
HALFSTREET FLOOD WIDTH(FEET) = 8.09
AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.73
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.46
STREET FLOW TRAVEL TIME(MIN.) = 4.90 Tc(MIN.) = 13.98
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.394
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4100
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.410
SUBAREA AREA(ACRES) = 1.04 SUBAREA RUNOFF(CFS) = 1.45
TOTAL AREA(ACRES) = 1.3 PEAK FLOW RATE(CFS) = 1.86

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.29 HALFSTREET FLOOD WIDTH(FEET) = 9.46
FLOW VELOCITY(FEET/SEC.) = 1.90 DEPTH*VELOCITY(FT*FT/SEC.) = 0.56
LONGEST FLOWPATH FROM NODE 700.00 TO NODE 700.20 = 609.00 FEET.
*****
FLOW PROCESS FROM NODE      700.20 TO NODE      700.30 IS CODE = 31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 313.24 DOWNSTREAM(FEET) = 311.80
FLOW LENGTH(FEET) = 118.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.75
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.86
PIPE TRAVEL TIME(MIN.) = 0.41 Tc(MIN.) = 14.39
LONGEST FLOWPATH FROM NODE 700.00 TO NODE 700.30 = 727.00 FEET.
*****
FLOW PROCESS FROM NODE      700.30 TO NODE      700.30 IS CODE = 81
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.331
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .4100
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
SUBAREA AREA(ACRES) = 4.94 SUBAREA RUNOFF(CFS) = 6.75
TOTAL AREA(ACRES) = 6.3 TOTAL RUNOFF(CFS) = 8.58
TC(MIN.) = 14.39
*****
FLOW PROCESS FROM NODE      700.30 TO NODE      700.30 IS CODE = 81
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 3.331
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4096
SUBAREA AREA(ACRES) = 0.04 SUBAREA RUNOFF(CFS) = 0.05
TOTAL AREA(ACRES) = 6.3 TOTAL RUNOFF(CFS) = 8.62
TC(MIN.) = 14.39

```

```

*****
FLOW PROCESS FROM NODE    100.10 TO NODE    100.10 IS CODE =   7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 20.89  RAIN INTENSITY(INCH/HOUR) = 2.62
TOTAL AREA(ACRES) = 6.32  TOTAL RUNOFF(CFS) = 5.28

*****
FLOW PROCESS FROM NODE    100.10 TO NODE    100.11 IS CODE =  31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 305.30  DOWNSTREAM(FEET) = 300.94
FLOW LENGTH(FEET) = 10.50  MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 4.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 23.18
ESTIMATED PIPE DIAMETER(INCH) = 9.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 5.28
PIPE TRAVEL TIME(MIN.) = 0.01  Tc(MIN.) = 20.90
LONGEST FLOWPATH FROM NODE 700.00 TO NODE 100.11 = 737.50 FEET.

*****
FLOW PROCESS FROM NODE    100.11 TO NODE    100.11 IS CODE =  11
-----
>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<
=====
** MAIN STREAM CONFLUENCE DATA **
STREAM  RUNOFF  Tc  INTENSITY  AREA
NUMBER  (CFS)  (MIN.)  (INCH/HOUR)  (ACRE)
1        5.28  20.90      2.618      6.32
LONGEST FLOWPATH FROM NODE 700.00 TO NODE 100.11 = 737.50 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **
STREAM  RUNOFF  Tc  INTENSITY  AREA
NUMBER  (CFS)  (MIN.)  (INCH/HOUR)  (ACRE)
1        2.48  21.97      2.536     11.43
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.11 = 1459.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM  RUNOFF  Tc  INTENSITY
NUMBER  (CFS)  (MIN.)  (INCH/HOUR)
1        7.64  20.90      2.618
2        7.59  21.97      2.536

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 7.64  Tc(MIN.) = 20.90
TOTAL AREA(ACRES) = 17.8

*****
FLOW PROCESS FROM NODE    100.11 TO NODE    100.11 IS CODE =  12
-----
>>>>CLEAR MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE    100.11 TO NODE    100.12 IS CODE =  31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====

```

```

ELEVATION DATA: UPSTREAM(FEET) = 300.94  DOWNSTREAM(FEET) = 300.80
FLOW LENGTH(FEET) = 24.90  MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.05
ESTIMATED PIPE DIAMETER(INCH) = 21.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.64
PIPE TRAVEL TIME(MIN.) = 0.08  Tc(MIN.) = 20.98
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.12 = 1483.90 FEET.

*****
FLOW PROCESS FROM NODE    100.12 TO NODE    100.12 IS CODE =  10
-----
>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE    100.12 TO NODE    100.12 IS CODE =  7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 104.58  RAIN INTENSITY(INCH/HOUR) = 0.93
TOTAL AREA(ACRES) = 17.80  TOTAL RUNOFF(CFS) = 2.38

*****
FLOW PROCESS FROM NODE    100.12 TO NODE    100.12 IS CODE =  1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 104.58
RAINFALL INTENSITY(INCH/HR) = 0.93
TOTAL STREAM AREA(ACRES) = 17.80
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.38

*****
FLOW PROCESS FROM NODE    600.00 TO NODE    600.10 IS CODE =  21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7600
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 144.00
UPSTREAM ELEVATION(FEET) = 322.44
DOWNSTREAM ELEVATION(FEET) = 320.95
ELEVATION DIFFERENCE(FEET) = 1.49
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.891
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH = 65.35
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.587
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) = 1.35
TOTAL AREA(ACRES) = 0.27  TOTAL RUNOFF(CFS) = 1.35

*****
FLOW PROCESS FROM NODE    600.10 TO NODE    600.20 IS CODE =  51
-----
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 320.95  DOWNSTREAM(FEET) = 317.90

```

```

CHANNEL LENGTH THRU SUBAREA(FEET) = 100.00 CHANNEL SLOPE = 0.0305
CHANNEL BASE( FEET) = 5.00 "Z" FACTOR = 10.000
MANNING'S FACTOR = 0.018 MAXIMUM DEPTH( FEET) = 1.00
100 YEAR RAINFALL INTENSITY( INCH/HOUR) = 6.230
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7600
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.16
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY( FEET/SEC.) = 2.98
AVERAGE FLOW DEPTH( FEET) = 0.12 TRAVEL TIME( MIN.) = 0.56
Tc( MIN.) = 5.45
SUBAREA AREA( ACRES) = 0.34 SUBAREA RUNOFF( CFS) = 1.61
AREA-AVERAGE RUNOFF COEFFICIENT = 0.760
TOTAL AREA( ACRES) = 0.6 PEAK FLOW RATE( CFS) = 2.89

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH( FEET) = 0.13 FLOW VELOCITY( FEET/SEC.) = 3.39
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 600.20 = 244.00 FEET.

*****
FLOW PROCESS FROM NODE 600.20 TO NODE 600.20 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY( INCH/HOUR) = 6.230
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7534
SUBAREA AREA( ACRES) = 0.01 SUBAREA RUNOFF( CFS) = 0.02
TOTAL AREA( ACRES) = 0.6 TOTAL RUNOFF( CFS) = 2.91
TC( MIN.) = 5.45

*****
FLOW PROCESS FROM NODE 600.20 TO NODE 600.20 IS CODE = 7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC( MIN) = 5.55 RAIN INTENSITY( INCH/HOUR) = 6.16
TOTAL AREA( ACRES) = 0.62 TOTAL RUNOFF( CFS) = 2.87

*****
FLOW PROCESS FROM NODE 600.20 TO NODE 600.30 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM( FEET) = 313.40 DOWNSTREAM( FEET) = 305.30
FLOW LENGTH( FEET) = 274.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.9 INCHES
PIPE-FLOW VELOCITY( FEET/SEC.) = 7.39
ESTIMATED PIPE DIAMETER( INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW( CFS) = 2.87
PIPE TRAVEL TIME( MIN.) = 0.62 Tc( MIN.) = 6.17
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 600.30 = 518.00 FEET.

*****
FLOW PROCESS FROM NODE 600.30 TO NODE 600.40 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM( FEET) = 310.35 DOWNSTREAM( FEET) = 307.69
FLOW LENGTH( FEET) = 266.00 MANNING'S N = 0.013

```

```

DEPTH OF FLOW IN 12.0 INCH PIPE IS 8.5 INCHES
PIPE-FLOW VELOCITY( FEET/SEC.) = 4.85
ESTIMATED PIPE DIAMETER( INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW( CFS) = 2.87
PIPE TRAVEL TIME( MIN.) = 0.92 Tc( MIN.) = 7.08
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 600.40 = 784.00 FEET.

*****
FLOW PROCESS FROM NODE 600.40 TO NODE 100.12 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION( MIN.) = 7.08
RAINFALL INTENSITY( INCH/HR) = 5.26
TOTAL STREAM AREA( ACRES) = 0.62
PEAK FLOW RATE( CFS) AT CONFLUENCE = 2.87

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 2.38 104.58 0.927 17.80
2 2.87 7.08 5.262 0.62

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/HOUR)
1 3.03 7.08 5.262
2 2.89 104.58 0.927

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE( CFS) = 3.03 Tc( MIN.) = 7.08
TOTAL AREA( ACRES) = 18.4
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.12 = 1483.90 FEET.

*****
FLOW PROCESS FROM NODE 100.13 TO NODE 100.14 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM( FEET) = 297.80 DOWNSTREAM( FEET) = 293.86
FLOW LENGTH( FEET) = 184.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.8 INCHES
PIPE-FLOW VELOCITY( FEET/SEC.) = 6.63
ESTIMATED PIPE DIAMETER( INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW( CFS) = 3.03
PIPE TRAVEL TIME( MIN.) = 0.46 Tc( MIN.) = 7.55
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.14 = 1667.90 FEET.

*****
FLOW PROCESS FROM NODE 100.14 TO NODE 100.15 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM( FEET) = 293.86 DOWNSTREAM( FEET) = 290.67
FLOW LENGTH( FEET) = 53.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 6.0 INCHES
PIPE-FLOW VELOCITY( FEET/SEC.) = 9.67

```

```

ESTIMATED PIPE DIAMETER(INCH) = 9.00    NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.03
PIPE TRAVEL TIME(MIN.) = 0.09    Tc(MIN.) = 7.64
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.15 = 1720.90 FEET.

*****
FLOW PROCESS FROM NODE 100.15 TO NODE 100.16 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 290.67 DOWNSTREAM(FEET) = 289.20
FLOW LENGTH(FEET) = 25.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 6.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 9.59
ESTIMATED PIPE DIAMETER(INCH) = 9.00    NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.03
PIPE TRAVEL TIME(MIN.) = 0.04    Tc(MIN.) = 7.68
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.16 = 1745.90 FEET.
=====
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 18.4    Tc(MIN.) = 7.68
PEAK FLOW RATE(CFS) = 3.03
=====
END OF RATIONAL METHOD ANALYSIS

```

## POST-DEVELOPMENT CONDITION (MITIGATED)

```
*****
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
          2003,1985,1981 HYDROLOGY MANUAL
(c) Copyright 1982-2016 Advanced Engineering Software (aes)
Ver. 23.0 Release Date: 07/01/2016 License ID 1452

Analysis prepared by:

PASCO LARET SUITER & ASSOCIATES
535 NORTH HIGHWAY 101, STE A
SOLANA BEACH, CA 92075
858-259-8212

***** DESCRIPTION OF STUDY *****
* 3084 Fox Point *
* Proposed Condition Detained *
* 100-yr *
*****
FILE NAME: 3084PDB.DAT
TIME/DATE OF STUDY: 11:47 07/22/2020
-----
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-----
2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT (YEAR) = 100.00
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500
SPECIFIED MINIMUM PIPE SIZE (INCH) = 4.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
  HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING
  WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)
== =====
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0313 0.167 0.0150
2 12.0 7.0 0.020/0.020/0.020 0.50 1.50 0.0100 0.125 0.0180

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
   as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*****
FLOW PROCESS FROM NODE 200.00 TO NODE 200.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED (SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH (FEET) = 124.00
UPSTREAM ELEVATION (FEET) = 319.55
DOWNSTREAM ELEVATION (FEET) = 318.90
ELEVATION DIFFERENCE (FEET) = 0.65
SUBAREA OVERLAND TIME OF FLOW (MIN.) = 7.155
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH = 50.73
```

```
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 5.228
SUBAREA RUNOFF (CFS) = 1.46
TOTAL AREA (ACRES) = 0.43 TOTAL RUNOFF (CFS) = 1.46

*****
FLOW PROCESS FROM NODE 200.10 TO NODE 200.10 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 5.228
*USER SPECIFIED (SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.6432
SUBAREA AREA (ACRES) = 0.01 SUBAREA RUNOFF (CFS) = 0.02
TOTAL AREA (ACRES) = 0.4 TOTAL RUNOFF (CFS) = 1.48
TC (MIN.) = 7.15

*****
FLOW PROCESS FROM NODE 200.10 TO NODE 200.10 IS CODE = 7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC (MIN) = 7.55 RAIN INTENSITY (INCH/HOUR) = 5.05
TOTAL AREA (ACRES) = 0.40 TOTAL RUNOFF (CFS) = 1.42

*****
FLOW PROCESS FROM NODE 200.10 TO NODE 200.20 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM (FEET) = 311.60 DOWNSTREAM (FEET) = 311.24
FLOW LENGTH (FEET) = 24.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.8 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 4.76
ESTIMATED PIPE DIAMETER (INCH) = 9.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 1.42
PIPE TRAVEL TIME (MIN.) = 0.08 Tc (MIN.) = 7.63
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.20 = 148.00 FEET.

*****
FLOW PROCESS FROM NODE 200.20 TO NODE 200.30 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM (FEET) = 311.24 DOWNSTREAM (FEET) = 308.38
FLOW LENGTH (FEET) = 191.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.8 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 4.76
ESTIMATED PIPE DIAMETER (INCH) = 9.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 1.42
PIPE TRAVEL TIME (MIN.) = 0.67 Tc (MIN.) = 8.30
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.30 = 339.00 FEET.

*****
FLOW PROCESS FROM NODE 200.30 TO NODE 200.40 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
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ELEVATION DATA: UPSTREAM(FEET) = 308.38 DOWNSTREAM(FEET) = 307.66
FLOW LENGTH(FEET) = 48.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.78
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.42
PIPE TRAVEL TIME(MIN.) = 0.17 Tc(MIN.) = 8.47
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.40 = 387.00 FEET.

*****
FLOW PROCESS FROM NODE 200.40 TO NODE 200.40 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 8.47
RAINFALL INTENSITY(INCH/HR) = 4.69
TOTAL STREAM AREA(ACRES) = 0.40
PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.42

*****
FLOW PROCESS FROM NODE 300.00 TO NODE 300.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
UPSTREAM ELEVATION(FEET) = 320.02
DOWNSTREAM ELEVATION(FEET) = 319.02
ELEVATION DIFFERENCE(FEET) = 1.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.530
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 65.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.545
SUBAREA RUNOFF(CFS) = 0.61
TOTAL AREA(ACRES) = 0.17 TOTAL RUNOFF(CFS) = 0.61

*****
FLOW PROCESS FROM NODE 300.10 TO NODE 300.20 IS CODE = 51
-----
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 319.02 DOWNSTREAM(FEET) = 318.50
CHANNEL LENGTH THRU SUBAREA(FEET) = 136.00 CHANNEL SLOPE = 0.0038
CHANNEL BASE(FEET) = 5.00 "2" FACTOR = 1.250
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 2.00
100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.903
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.27
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.65
AVERAGE FLOW DEPTH(FEET) = 0.15 TRAVEL TIME(MIN.) = 1.37
Tc(MIN.) = 7.90
SUBAREA AREA(ACRES) = 0.41 SUBAREA RUNOFF(CFS) = 1.31
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650
TOTAL AREA(ACRES) = 0.6 PEAK FLOW RATE(CFS) = 1.85

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

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DEPTH(FEET) = 0.19 FLOW VELOCITY(FEET/SEC.) = 1.90
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 300.20 = 236.00 FEET.

*****
FLOW PROCESS FROM NODE 300.20 TO NODE 300.20 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.903
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.6449
SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = 0.02
TOTAL AREA(ACRES) = 0.6 TOTAL RUNOFF(CFS) = 1.87
Tc(MIN.) = 7.90

*****
FLOW PROCESS FROM NODE 300.20 TO NODE 300.20 IS CODE = 7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
Tc(MIN) = 8.10 RAIN INTENSITY(INCH/HR) = 4.83
TOTAL AREA(ACRES) = 0.60 TOTAL RUNOFF(CFS) = 1.83

*****
FLOW PROCESS FROM NODE 300.20 TO NODE 200.40 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 313.80 DOWNSTREAM(FEET) = 307.66
FLOW LENGTH(FEET) = 12.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 6.0 INCH PIPE IS 2.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 19.20
ESTIMATED PIPE DIAMETER(INCH) = 6.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.83
PIPE TRAVEL TIME(MIN.) = 0.01 Tc(MIN.) = 8.11
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 200.40 = 248.00 FEET.

*****
FLOW PROCESS FROM NODE 200.40 TO NODE 200.40 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 8.11
RAINFALL INTENSITY(INCH/HR) = 4.82
TOTAL STREAM AREA(ACRES) = 0.60
PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.83

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HR) (ACRE)
1 1.42 8.47 4.688 0.40
2 1.83 8.11 4.821 0.60

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY

```

4

NUMBER	(CFS)	(MIN.)	(INCH/HOUR)
1	3.19	8.11	4.821
2	3.20	8.47	4.688

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
 PEAK FLOW RATE(CFS) = 3.20 TC(MIN.) = 8.47  
 TOTAL AREA(ACRES) = 1.0  
 LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.40 = 387.00 FEET.

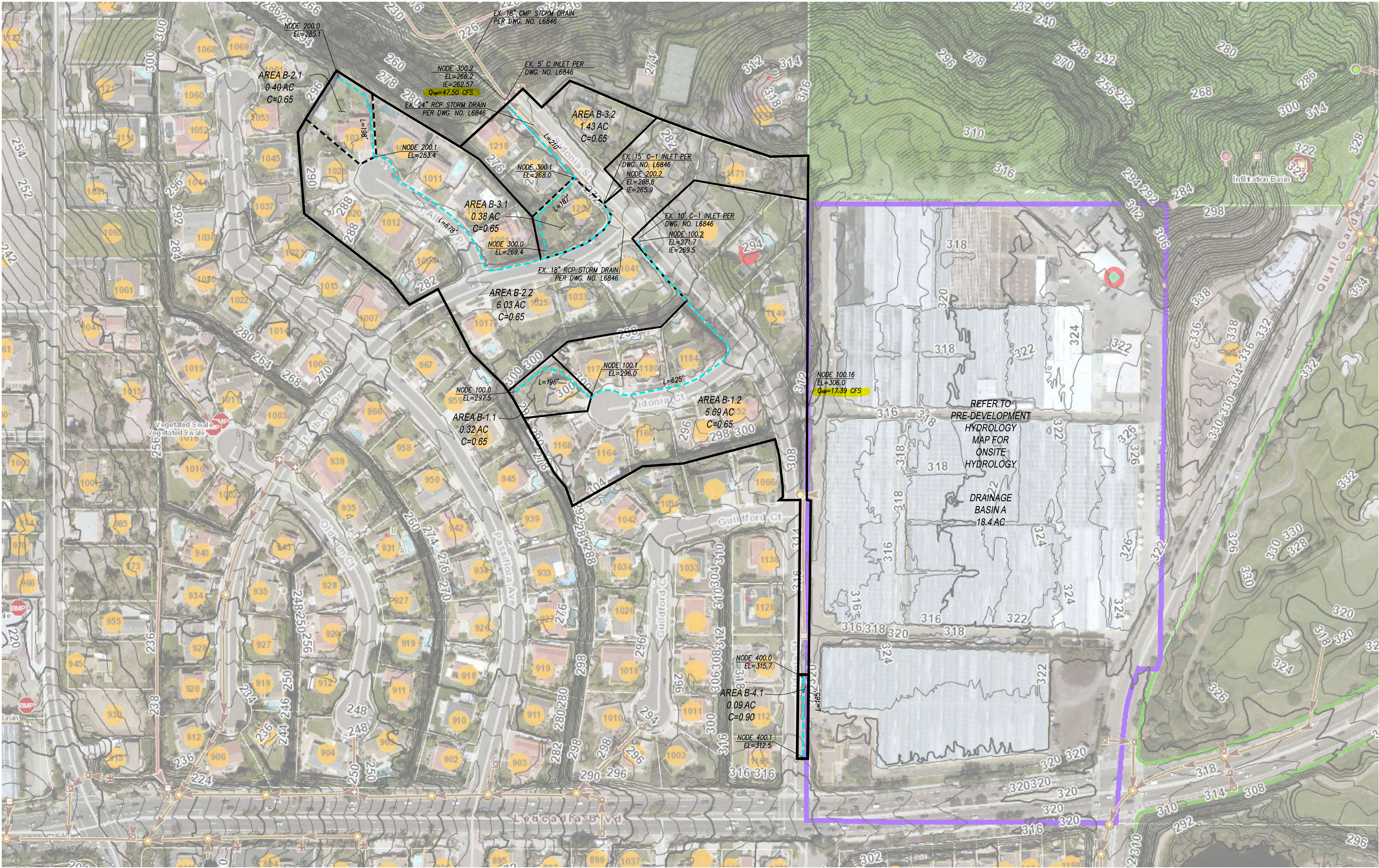
\*\*\*\*\*  
 FLOW PROCESS FROM NODE 200.40 TO NODE 200.50 IS CODE = 31  
 -----  
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<  
 =====  
 ELEVATION DATA: UPSTREAM( FEET ) = 307.66 DOWNSTREAM( FEET ) = 307.20  
 FLOW LENGTH( FEET ) = 16.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.4 INCHES  
 PIPE-FLOW VELOCITY( FEET/SEC. ) = 7.50  
 ESTIMATED PIPE DIAMETER( INCH ) = 12.00 NUMBER OF PIPES = 1  
 PIPE-FLOW( CFS ) = 3.20  
 PIPE TRAVEL TIME( MIN. ) = 0.04 TC( MIN. ) = 8.51  
 LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.50 = 403.00 FEET.  
 =====  
 END OF STUDY SUMMARY:  
 TOTAL AREA( ACRES ) = 1.0 TC( MIN. ) = 8.51  
 PEAK FLOW RATE( CFS ) = 3.20  
 =====  
 END OF RATIONAL METHOD ANALYSIS

## **APPENDIX D**

### **Offsite Hydrology Analysis Node Map**

# PRE-DEVELOPMENT OFFSITE HYDROLOGY NODE MAP

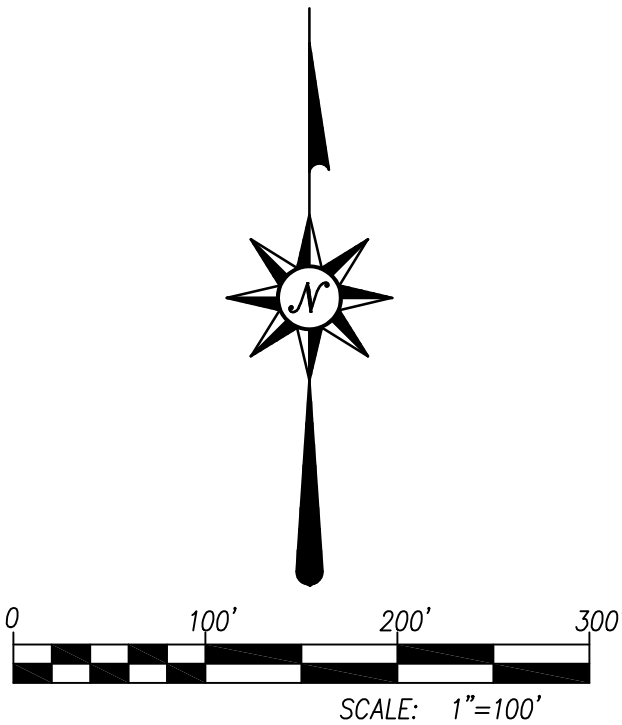
## FOX POINT, ENCINITAS, CA



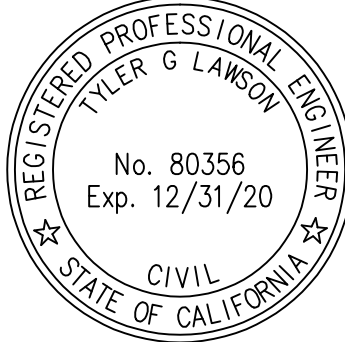
- LEGEND**
- PROJECT BOUNDARY
  - DRAINAGE PATH OF TRAVEL
  - BASIN BOUNDARY
  - SUB-BASIN BOUNDARY
  - INITIAL SUB-BASIN BOUNDARY

PLAN VIEW - FOX POINT OFFSITE HYDROLOGY NODE MAP

SCALE: 1"=100'



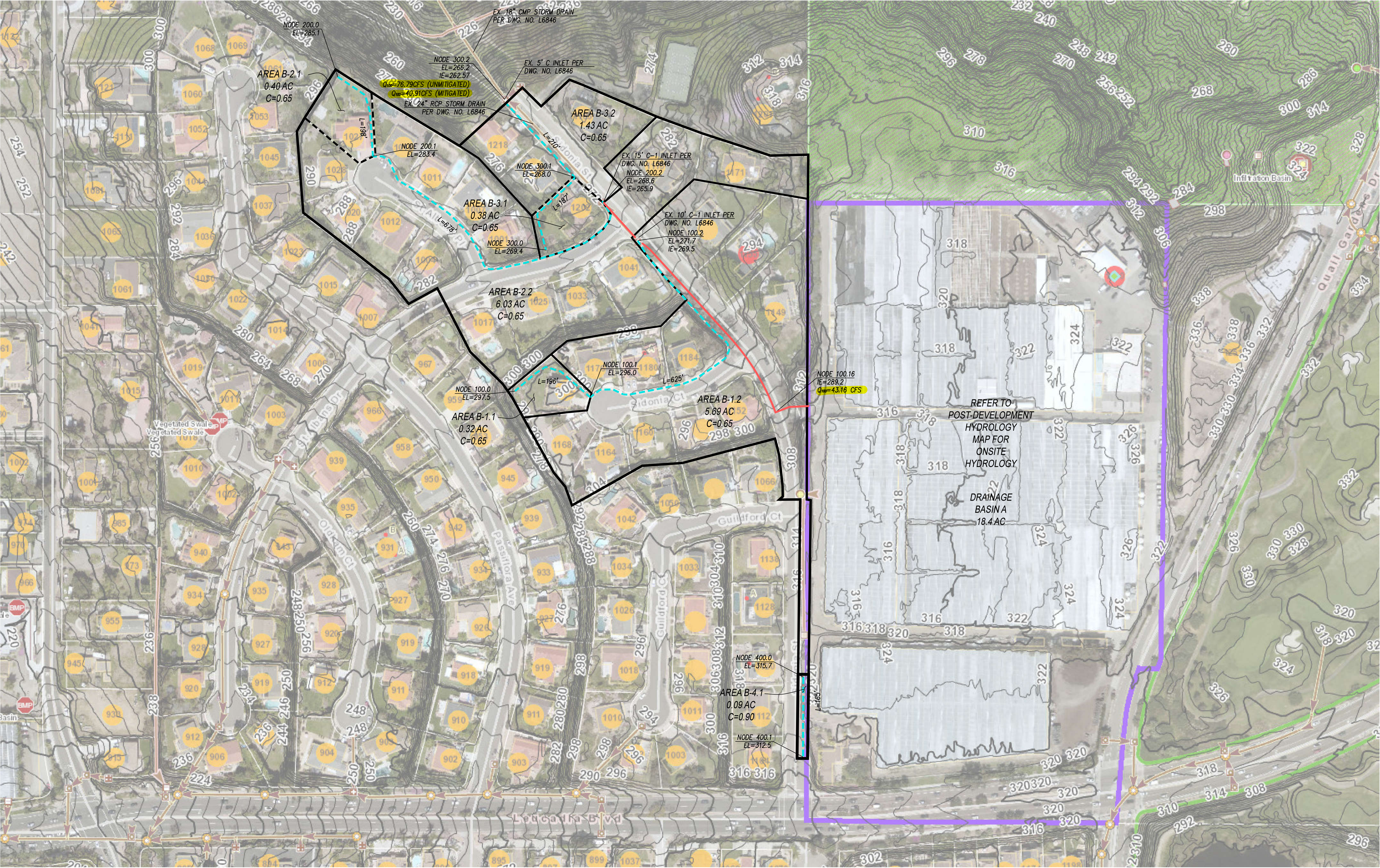
PREPARED BY:



**PASCO LARET SUITER & ASSOCIATES**  
CIVIL ENGINEERING + LAND PLANNING + LAND SURVEYING  
535 North Highway 101, Ste A, Solana Beach, CA 92075  
ph 858.259.8212 | fx 858.259.4812 | plesengineering.com

# POST-DEVELOPMENT OFFSITE HYDROLOGY NODE MAP

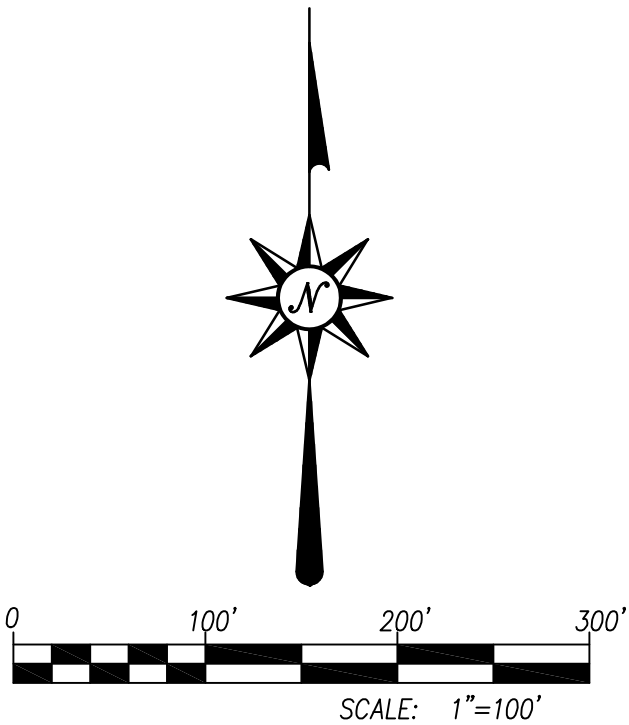
## FOX POINT, ENCINITAS, CA



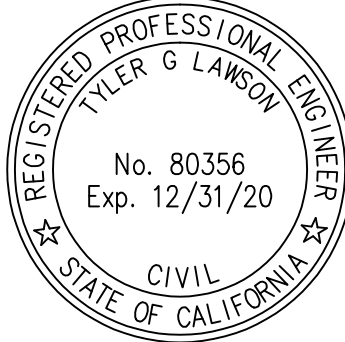
- LEGEND**
- PROJECT BOUNDARY
  - DRAINAGE PATH OF TRAVEL
  - BASIN BOUNDARY
  - SUB-BASIN BOUNDARY
  - INITIAL SUB-BASIN BOUNDARY
  - PROPOSED 24" STORM DRAIN

PLAN VIEW - FOX POINT OFFSITE HYDROLOGY NODE MAP

SCALE: 1" = 100'



PREPARED BY:



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## **APPENDIX E**

### **AES Pre and Post-Development Output Report for Offsite Improvements**

## **AES Pre-Development Output Report**

## OFFSITE PRE-DEVELOPMENT CONDITION

```
*****
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
          2003,1985,1981 HYDROLOGY MANUAL
(c) Copyright 1982-2016 Advanced Engineering Software (aes)
   Ver. 23.0 Release Date: 07/01/2016 License ID 1452

Analysis prepared by:

PASCO LARET SUITER & ASSOCIATES
535 NORTH HIGHWAY 101, STE A
SOLANA BEACH, CA 92075
858-259-8212

***** DESCRIPTION OF STUDY *****
* 3084 FOX POINT *
* 100-YR OFFSITE SIDONIA STREET ANALYSIS *
* EXISTING CONDITION *
*****
FILE NAME: 3084EOFF.DAT
TIME/DATE OF STUDY: 14:15 07/22/2020
-----
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-----
2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT (YEAR) = 100.00
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500
SPECIFIED MINIMUM PIPE SIZE (INCH) = 12.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
  HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING
  WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)
== =====
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0313 0.167 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.50 FEET
   as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*****
FLOW PROCESS FROM NODE 100.16 TO NODE 100.16 IS CODE = 7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 17.71 RAIN INTENSITY(INCH/HOUR) = 2.91
TOTAL AREA(ACRES) = 13.90 TOTAL RUNOFF(CFS) = 17.39

*****
FLOW PROCESS FROM NODE 100.16 TO NODE 300.20 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STANDARD CURB SECTION USED)<<<<
=====
UPSTREAM ELEVATION (FEET) = 306.00 DOWNSTREAM ELEVATION (FEET) = 266.20
```

```
STREET LENGTH (FEET) = 910.00 CURB HEIGHT (INCHES) = 6.0
STREET HALFWIDTH (FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 11.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 17.39
***STREET FLOW SPLITS OVER STREET-CROWN***
FULL DEPTH (FEET) = 0.45 FLOOD WIDTH (FEET) = 16.00
FULL HALF-STREET VELOCITY (FEET/SEC.) = 5.14
SPLIT DEPTH (FEET) = 0.31 SPLIT FLOOD WIDTH (FEET) = 9.25
SPLIT FLOW (CFS) = 3.62 SPLIT VELOCITY (FEET/SEC.) = 3.72
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.45
HALFSTREET FLOOD WIDTH (FEET) = 16.00
AVERAGE FLOW VELOCITY (FEET/SEC.) = 5.14
PRODUCT OF DEPTH&VELOCITY (FT*FT/SEC.) = 2.29
STREET FLOW TRAVEL TIME (MIN.) = 2.95 Tc (MIN.) = 20.66
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 2.638
AREA-AVERAGE RUNOFF COEFFICIENT = 0.429
SUBAREA AREA (ACRES) = 0.00 SUBAREA RUNOFF (CFS) = 0.00
TOTAL AREA (ACRES) = 13.9 PEAK FLOW RATE (CFS) = 17.39

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.45 HALFSTREET FLOOD WIDTH (FEET) = 16.00
FLOW VELOCITY (FEET/SEC.) = 5.14 DEPTH*VELOCITY (FT*FT/SEC.) = 2.29
LONGEST FLOWPATH FROM NODE 0.00 TO NODE 300.20 = 910.00 FEET.

*****
FLOW PROCESS FROM NODE 300.20 TO NODE 300.20 IS CODE = 10
-----
>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE 100.00 TO NODE 100.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED (SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH (FEET) = 196.00
UPSTREAM ELEVATION (FEET) = 297.50
DOWNSTREAM ELEVATION (FEET) = 296.00
ELEVATION DIFFERENCE (FEET) = 1.50
SUBAREA OVERLAND TIME OF FLOW (MIN.) = 6.894
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH = 60.61
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 5.354
SUBAREA RUNOFF (CFS) = 1.11
TOTAL AREA (ACRES) = 0.32 TOTAL RUNOFF (CFS) = 1.11

*****
FLOW PROCESS FROM NODE 100.10 TO NODE 100.20 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
```

```

>>>>>(STANDARD CURB SECTION USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 296.00 DOWNSTREAM ELEVATION(FEET) = 271.70
STREET LENGTH(FEET) = 625.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 9.14
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.34
HALFSTREET FLOOD WIDTH(FEET) = 10.46
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.77
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.27
STREET FLOW TRAVEL TIME(MIN.) = 2.76 Tc(MIN.) = 9.65
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.309
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650
SUBAREA AREA(ACRES) = 5.69 SUBAREA RUNOFF(CFS) = 15.94
TOTAL AREA(ACRES) = 6.0 PEAK FLOW RATE(CFS) = 16.83

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.40 HALFSTREET FLOOD WIDTH(FEET) = 13.46
FLOW VELOCITY(FEET/SEC.) = 4.36 DEPTH*VELOCITY(FT*FT/SEC.) = 1.72
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.20 = 821.00 FEET.

*****
FLOW PROCESS FROM NODE 100.20 TO NODE 200.20 IS CODE = 41
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 269.50 DOWNSTREAM(FEET) = 265.90
FLOW LENGTH(FEET) = 112.50 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 11.77
GIVEN PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 16.83
PIPE TRAVEL TIME(MIN.) = 0.16 Tc(MIN.) = 9.81
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 200.20 = 933.50 FEET.

*****
FLOW PROCESS FROM NODE 200.20 TO NODE 200.20 IS CODE = 1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 9.81
RAINFALL INTENSITY(INCH/HR) = 4.26
TOTAL STREAM AREA(ACRES) = 6.01
PEAK FLOW RATE(CFS) AT CONFLUENCE = 16.83

*****
FLOW PROCESS FROM NODE 200.00 TO NODE 200.10 IS CODE = 21
-----

```

3

```

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 198.00
UPSTREAM ELEVATION(FEET) = 285.10
DOWNSTREAM ELEVATION(FEET) = 283.40
ELEVATION DIFFERENCE(FEET) = 1.70
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.643
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 60.76
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.484
SUBAREA RUNOFF(CFS) = 1.43
TOTAL AREA(ACRES) = 0.40 TOTAL RUNOFF(CFS) = 1.43

*****
FLOW PROCESS FROM NODE 200.10 TO NODE 200.20 IS CODE = 61
-----
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 283.40 DOWNSTREAM ELEVATION(FEET) = 268.60
STREET LENGTH(FEET) = 678.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 9.61
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.37
HALFSTREET FLOOD WIDTH(FEET) = 12.00
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.08
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.13
STREET FLOW TRAVEL TIME(MIN.) = 3.67 Tc(MIN.) = 10.31
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.130
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650
SUBAREA AREA(ACRES) = 6.03 SUBAREA RUNOFF(CFS) = 16.19
TOTAL AREA(ACRES) = 6.4 PEAK FLOW RATE(CFS) = 17.26

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.43 HALFSTREET FLOOD WIDTH(FEET) = 15.27
FLOW VELOCITY(FEET/SEC.) = 3.52 DEPTH*VELOCITY(FT*FT/SEC.) = 1.52
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.20 = 876.00 FEET.

*****
FLOW PROCESS FROM NODE 200.20 TO NODE 200.20 IS CODE = 1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:

```

4

TIME OF CONCENTRATION(MIN.) = 10.31  
RAINFALL INTENSITY(INCH/HR) = 4.13  
TOTAL STREAM AREA(ACRES) = 6.43  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 17.26

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	16.83	9.81	4.264	6.01
2	17.26	10.31	4.130	6.43

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
CONFLUENCE FORMULA USED FOR 2 STREAMS.

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	33.26	9.81	4.264
2	33.57	10.31	4.130

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 33.57 Tc(MIN.) = 10.31  
TOTAL AREA(ACRES) = 12.4  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 200.20 = 933.50 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 200.20 TO NODE 300.20 IS CODE = 41  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<  
=====

ELEVATION DATA: UPSTREAM(FEET) = 265.90 DOWNSTREAM(FEET) = 262.57  
FLOW LENGTH(FEET) = 333.00 MANNING'S N = 0.013  
ASSUME FULL-FLOWING PIPELINE  
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.75  
(PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW  
AT DEPTH = 0.94 \* DIAMETER)  
GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 33.57  
PIPE TRAVEL TIME(MIN.) = 0.72 Tc(MIN.) = 11.03  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 300.20 = 1266.50 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 300.20 TO NODE 300.20 IS CODE = 1  
-----

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<  
=====

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:  
TIME OF CONCENTRATION(MIN.) = 11.03  
RAINFALL INTENSITY(INCH/HR) = 3.95  
TOTAL STREAM AREA(ACRES) = 12.44  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 33.57

\*\*\*\*\*  
FLOW PROCESS FROM NODE 300.00 TO NODE 300.10 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<  
=====

\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .6500  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 187.00  
UPSTREAM ELEVATION(FEET) = 269.40  
DOWNSTREAM ELEVATION(FEET) = 268.00

5

ELEVATION DIFFERENCE(FEET) = 1.40  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.762  
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN  
THE MAXIMUM OVERLAND FLOW LENGTH = 57.46  
(Reference: Table 3-1B of Hydrology Manual)  
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.421  
SUBAREA RUNOFF(CFS) = 1.34  
TOTAL AREA(ACRES) = 0.38 TOTAL RUNOFF(CFS) = 1.34

\*\*\*\*\*  
FLOW PROCESS FROM NODE 300.10 TO NODE 300.20 IS CODE = 61  
-----

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>(STANDARD CURB SECTION USED)<<<<  
=====

UPSTREAM ELEVATION(FEET) = 268.00 DOWNSTREAM ELEVATION(FEET) = 266.20  
STREET LENGTH(FEET) = 210.00 CURB HEIGHT(INCHES) = 6.0  
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00  
INSIDE STREET CROSSFALL(DECIMAL) = 0.020  
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1  
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020  
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.52  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH(FEET) = 0.38  
HALFSTREET FLOOD WIDTH(FEET) = 12.86  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.98  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 0.76  
STREET FLOW TRAVEL TIME(MIN.) = 1.76 Tc(MIN.) = 8.53  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.669  
\*USER SPECIFIED(SUBAREA):  
USER-SPECIFIED RUNOFF COEFFICIENT = .6500  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650  
SUBAREA AREA(ACRES) = 1.43 SUBAREA RUNOFF(CFS) = 4.34  
TOTAL AREA(ACRES) = 1.8 PEAK FLOW RATE(CFS) = 5.49

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH(FEET) = 0.43 HALFSTREET FLOOD WIDTH(FEET) = 15.36  
FLOW VELOCITY(FEET/SEC.) = 2.22 DEPTH\*VELOCITY(FT\*FT/SEC.) = 0.96  
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 300.20 = 397.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 300.20 TO NODE 300.20 IS CODE = 1  
-----

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<  
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<  
=====

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
TIME OF CONCENTRATION(MIN.) = 8.53  
RAINFALL INTENSITY(INCH/HR) = 4.67  
TOTAL STREAM AREA(ACRES) = 1.81  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.49

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
------------------	-----------------	--------------	--------------------------	----------------

6

1	33.57	11.03	3.955	12.44
2	5.49	8.53	4.669	1.81

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	33.93	8.53	4.669
2	38.22	11.03	3.955

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 38.22 Tc(MIN.) = 11.03  
TOTAL AREA(ACRES) = 14.2  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 300.20 = 1266.50 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 300.20 TO NODE 300.20 IS CODE = 11  
-----  
>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<  
=====

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	38.22	11.03	3.955	14.25

LONGEST FLOWPATH FROM NODE 100.00 TO NODE 300.20 = 1266.50 FEET.

\*\* MEMORY BANK # 1 CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	17.39	20.66	2.638	13.90

LONGEST FLOWPATH FROM NODE 0.00 TO NODE 300.20 = 910.00 FEET.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	47.50	11.03	3.955
2	42.88	20.66	2.638

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 47.50 Tc(MIN.) = 11.03  
TOTAL AREA(ACRES) = 28.1

=====

END OF STUDY SUMMARY:  
TOTAL AREA(ACRES) = 28.1 TC(MIN.) = 11.03  
PEAK FLOW RATE(CFS) = 47.50

=====

END OF RATIONAL METHOD ANALYSIS

**AES Post-Development Output Report (Unmitigated)**

## OFFSITE POST-DEVELOPMENT CONDITION (UNMITIGATED)

```
*****
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
          2003,1985,1981 HYDROLOGY MANUAL
(c) Copyright 1982-2016 Advanced Engineering Software (aes)
   Ver. 23.0 Release Date: 07/01/2016   License ID 1452

      Analysis prepared by:

      PASCO LARET SUITER & ASSOCIATES
      535 NORTH HIGHWAY 101, STE A
      SOLANA BEACH, CA 92075
      858-259-8212

***** DESCRIPTION OF STUDY *****
* 3084 FOX POINT *
* 100-YR OFFSITE SIDONIA STREET ANALYSIS *
* PROPOSED SIDONIA STREET WIDENING IMPROVEMENT CONDITION *
*****
FILE NAME: 3084POFF.DAT
TIME/DATE OF STUDY: 08:18 07/27/2020
-----
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-----
2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT (YEAR) = 100.00
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500
SPECIFIED MINIMUM PIPE SIZE (INCH) = 12.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
  HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING
  WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)
== =====
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0313 0.167 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.50 FEET
   as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*****
FLOW PROCESS FROM NODE 100.16 TO NODE 100.16 IS CODE = 7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 11.98 RAIN INTENSITY(INCH/ HOUR) = 3.75
TOTAL AREA(ACRES) = 18.40 TOTAL RUNOFF(CFS) = 43.16

*****
FLOW PROCESS FROM NODE 100.16 TO NODE 100.20 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 289.20 DOWNSTREAM(FEET) = 269.50
```

```
FLOW LENGTH(FEET) = 448.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 18.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 16.74
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 43.16
PIPE TRAVEL TIME(MIN.) = 0.45 Tc(MIN.) = 12.43
LONGEST FLOWPATH FROM NODE 0.00 TO NODE 100.20 = 448.00 FEET.

*****
FLOW PROCESS FROM NODE 100.20 TO NODE 100.20 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION (MIN.) = 12.43
RAINFALL INTENSITY (INCH/HR) = 3.66
TOTAL STREAM AREA (ACRES) = 18.40
PEAK FLOW RATE (CFS) AT CONFLUENCE = 43.16

*****
FLOW PROCESS FROM NODE 100.00 TO NODE 100.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED (SUBAREA) :
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH (FEET) = 196.00
UPSTREAM ELEVATION (FEET) = 297.50
DOWNSTREAM ELEVATION (FEET) = 296.00
ELEVATION DIFFERENCE (FEET) = 1.50
SUBAREA OVERLAND TIME OF FLOW (MIN.) = 6.894
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH = 60.61
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY (INCH/HOUR) = 5.354
SUBAREA RUNOFF (CFS) = 1.11
TOTAL AREA (ACRES) = 0.32 TOTAL RUNOFF (CFS) = 1.11

*****
FLOW PROCESS FROM NODE 100.10 TO NODE 100.20 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STANDARD CURB SECTION USED)<<<<
=====
UPSTREAM ELEVATION (FEET) = 296.00 DOWNSTREAM ELEVATION (FEET) = 271.70
STREET LENGTH (FEET) = 625.00 CURB HEIGHT (INCHES) = 6.0
STREET HALFWIDTH (FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 11.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 9.14
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.34
HALFSTREET FLOOD WIDTH (FEET) = 10.46
AVERAGE FLOW VELOCITY (FEET/SEC.) = 3.77
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PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.27
STREET FLOW TRAVEL TIME(MIN.) = 2.76 Tc(MIN.) = 9.65
100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.309
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650
SUBAREA AREA(ACRES) = 5.69 SUBAREA RUNOFF(CFS) = 15.94
TOTAL AREA(ACRES) = 6.0 PEAK FLOW RATE(CFS) = 16.83

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.40 HALFSTREET FLOOD WIDTH(FEET) = 13.46
FLOW VELOCITY(FEET/SEC.) = 4.36 DEPTH*VELOCITY(FT*FT/SEC.) = 1.72
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.20 = 821.00 FEET.

*****
FLOW PROCESS FROM NODE 100.20 TO NODE 100.20 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 9.65
RAINFALL INTENSITY(INCH/HR) = 4.31
TOTAL STREAM AREA(ACRES) = 6.01
PEAK FLOW RATE(CFS) AT CONFLUENCE = 16.83

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HR) (ACRE)
1 43.16 12.43 3.662 18.40
2 16.83 9.65 4.309 6.01

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/HR)
1 50.37 9.65 4.309
2 57.46 12.43 3.662

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 57.46 Tc(MIN.) = 12.43
TOTAL AREA(ACRES) = 24.4
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.20 = 821.00 FEET.

*****
FLOW PROCESS FROM NODE 100.20 TO NODE 200.20 IS CODE = 41
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 269.50 DOWNSTREAM(FEET) = 265.90
FLOW LENGTH(FEET) = 112.50 MANNING'S N = 0.013
ASSUME FULL-FLOWING PIPELINE
PIPE-FLOW VELOCITY(FEET/SEC.) = 13.86
(Pipe flow velocity corresponding to normal-depth flow
at depth = 0.94 * diameter)
GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 57.46
PIPE TRAVEL TIME(MIN.) = 0.14 Tc(MIN.) = 12.56
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 200.20 = 933.50 FEET.

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*****
FLOW PROCESS FROM NODE 200.20 TO NODE 200.20 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 12.56
RAINFALL INTENSITY(INCH/HR) = 3.64
TOTAL STREAM AREA(ACRES) = 24.41
PEAK FLOW RATE(CFS) AT CONFLUENCE = 57.46

*****
FLOW PROCESS FROM NODE 200.00 TO NODE 200.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 198.00
UPSTREAM ELEVATION(FEET) = 285.10
DOWNSTREAM ELEVATION(FEET) = 283.40
ELEVATION DIFFERENCE(FEET) = 1.70
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.643
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 60.76
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.484
SUBAREA RUNOFF(CFS) = 1.43
TOTAL AREA(ACRES) = 0.40 TOTAL RUNOFF(CFS) = 1.43

*****
FLOW PROCESS FROM NODE 200.10 TO NODE 200.20 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STANDARD CURB SECTION USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 283.40 DOWNSTREAM ELEVATION(FEET) = 268.60
STREET LENGTH(FEET) = 678.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 9.61
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.37
HALFSTREET FLOOD WIDTH(FEET) = 12.00
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.08
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.13
STREET FLOW TRAVEL TIME(MIN.) = 3.67 Tc(MIN.) = 10.31
100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.130
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650
SUBAREA AREA(ACRES) = 6.03 SUBAREA RUNOFF(CFS) = 16.19

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TOTAL AREA(ACRES) =          6.4          PEAK FLOW RATE(CFS) =          17.26

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.43 HALFSTREET FLOOD WIDTH(FEET) = 15.27
FLOW VELOCITY(FEET/SEC.) = 3.52 DEPTH*VELOCITY(FT*FT/SEC.) = 1.52
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.20 = 876.00 FEET.

*****
FLOW PROCESS FROM NODE 200.20 TO NODE 200.20 IS CODE = 1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 10.31
RAINFALL INTENSITY(INCH/HR) = 4.13
TOTAL STREAM AREA(ACRES) = 6.43
PEAK FLOW RATE(CFS) AT CONFLUENCE = 17.26

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/ HOUR) (ACRE)
1 57.46 12.56 3.636 24.41
2 17.26 10.31 4.130 6.43

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/ HOUR)
1 67.85 10.31 4.130
2 72.66 12.56 3.636

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 72.66 Tc(MIN.) = 12.56
TOTAL AREA(ACRES) = 30.8
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 200.20 = 933.50 FEET.

*****
FLOW PROCESS FROM NODE 200.20 TO NODE 300.20 IS CODE = 41
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 265.90 DOWNSTREAM(FEET) = 262.57
FLOW LENGTH(FEET) = 333.00 MANNING'S N = 0.013
ASSUME FULL-FLOWING PIPELINE
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.75
(Pipe flow velocity corresponding to normal-depth flow
at depth = 0.94 * diameter)
GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 72.66
PIPE TRAVEL TIME(MIN.) = 0.72 Tc(MIN.) = 13.28
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 300.20 = 1266.50 FEET.

*****
FLOW PROCESS FROM NODE 300.20 TO NODE 300.20 IS CODE = 1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 13.28

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RAINFALL INTENSITY(INCH/HR) = 3.51
TOTAL STREAM AREA(ACRES) = 30.84
PEAK FLOW RATE(CFS) AT CONFLUENCE = 72.66

*****
FLOW PROCESS FROM NODE 300.00 TO NODE 300.10 IS CODE = 21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 187.00
UPSTREAM ELEVATION(FEET) = 269.40
DOWNSTREAM ELEVATION(FEET) = 268.00
ELEVATION DIFFERENCE(FEET) = 1.40
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.762
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 57.46
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.421
SUBAREA RUNOFF(CFS) = 1.34
TOTAL AREA(ACRES) = 0.38 TOTAL RUNOFF(CFS) = 1.34

*****
FLOW PROCESS FROM NODE 300.10 TO NODE 300.20 IS CODE = 61
-----
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 268.00 DOWNSTREAM ELEVATION(FEET) = 266.20
STREET LENGTH(FEET) = 210.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.52
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.38
HALFSTREET FLOOD WIDTH(FEET) = 12.86
AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.98
PRODUCT OF DEPTH*VELOCITY(FT*FT/SEC.) = 0.76
STREET FLOW TRAVEL TIME(MIN.) = 1.76 Tc(MIN.) = 8.53
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.669
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650
SUBAREA AREA(ACRES) = 1.43 SUBAREA RUNOFF(CFS) = 4.34
TOTAL AREA(ACRES) = 1.8 PEAK FLOW RATE(CFS) = 5.49

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.43 HALFSTREET FLOOD WIDTH(FEET) = 15.36
FLOW VELOCITY(FEET/SEC.) = 2.22 DEPTH*VELOCITY(FT*FT/SEC.) = 0.96
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 300.20 = 397.00 FEET.

*****

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6

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FLOW PROCESS FROM NODE      300.20 TO NODE      300.20 IS CODE =   1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 8.53
RAINFALL INTENSITY(INCH/HR) = 4.67
TOTAL STREAM AREA(ACRES) = 1.81
PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.49

** CONFLUENCE DATA **
STREAM   RUNOFF      Tc      INTENSITY      AREA
NUMBER   (CFS)      (MIN.)  (INCH/HR)    (ACRE)
1        72.66     13.28     3.508       30.84
2         5.49      8.53      4.669        1.81

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM   RUNOFF      Tc      INTENSITY
NUMBER   (CFS)      (MIN.)  (INCH/HR)
1         60.09      8.53     4.669
2         76.79     13.28     3.508

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 76.79   Tc(MIN.) = 13.28
TOTAL AREA(ACRES) = 32.7
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 300.20 = 1266.50 FEET.
=====
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 32.7   TC(MIN.) = 13.28
PEAK FLOW RATE(CFS) = 76.79
=====
END OF RATIONAL METHOD ANALYSIS

```

**AES Post-Development Output Report (Mitigated)**

## OFFSITE POST-DEVELOPMENT CONDITION (MITIGATED)

```
*****
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
          2003,1985,1981 HYDROLOGY MANUAL
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***** DESCRIPTION OF STUDY *****
* 3084 FOX POINT *
* 100-YR OFFSITE SIDONIA STREET ANALYSIS *
* PROPOSED DETAINED SIDONIA STREET IMPROVEMENT CONDITION *
*****
FILE NAME: 3084PDOF.DAT
TIME/DATE OF STUDY: 08:16 07/27/2020
-----
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-----
2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT (YEAR) = 100.00
6-HOUR DURATION PRECIPITATION (INCHES) = 2.500
SPECIFIED MINIMUM PIPE SIZE (INCH) = 12.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
  HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING
  WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)
=== =====
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0313 0.167 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.50 FEET
   as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*****
FLOW PROCESS FROM NODE 100.16 TO NODE 100.16 IS CODE = 7
-----
>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<
=====
USER-SPECIFIED VALUES ARE AS FOLLOWS:
TC(MIN) = 7.68 RAIN INTENSITY(INCH/ HOUR) = 4.99
TOTAL AREA(ACRES) = 18.40 TOTAL RUNOFF(CFS) = 3.03

*****
FLOW PROCESS FROM NODE 100.16 TO NODE 100.20 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 289.20 DOWNSTREAM(FEET) = 269.50
```

```
FLOW LENGTH(FEET) = 448.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.85
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.03
PIPE TRAVEL TIME(MIN.) = 0.84 Tc(MIN.) = 8.52
LONGEST FLOWPATH FROM NODE 0.00 TO NODE 100.20 = 448.00 FEET.

*****
FLOW PROCESS FROM NODE 100.20 TO NODE 100.20 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 8.52
RAINFALL INTENSITY(INCH/HR) = 4.67
TOTAL STREAM AREA(ACRES) = 18.40
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.03

*****
FLOW PROCESS FROM NODE 100.00 TO NODE 100.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 196.00
UPSTREAM ELEVATION(FEET) = 297.50
DOWNSTREAM ELEVATION(FEET) = 296.00
ELEVATION DIFFERENCE(FEET) = 1.50
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.894
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH = 60.61
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.354
SUBAREA RUNOFF(CFS) = 1.11
TOTAL AREA(ACRES) = 0.32 TOTAL RUNOFF(CFS) = 1.11

*****
FLOW PROCESS FROM NODE 100.10 TO NODE 100.20 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STANDARD CURB SECTION USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 296.00 DOWNSTREAM ELEVATION(FEET) = 271.70
STREET LENGTH(FEET) = 625.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 9.14
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.34
HALFSTREET FLOOD WIDTH(FEET) = 10.46
```

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AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.77
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.27
STREET FLOW TRAVEL TIME(MIN.) = 2.76 Tc(MIN.) = 9.65
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.309
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650
SUBAREA AREA(ACRES) = 5.69 SUBAREA RUNOFF(CFS) = 15.94
TOTAL AREA(ACRES) = 6.0 PEAK FLOW RATE(CFS) = 16.83

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.40 HALFSTREET FLOOD WIDTH(FEET) = 13.46
FLOW VELOCITY(FEET/SEC.) = 4.36 DEPTH*VELOCITY(FT*FT/SEC.) = 1.72
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.20 = 821.00 FEET.

*****
FLOW PROCESS FROM NODE 100.20 TO NODE 100.20 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 9.65
RAINFALL INTENSITY(INCH/HR) = 4.31
TOTAL STREAM AREA(ACRES) = 6.01
PEAK FLOW RATE(CFS) AT CONFLUENCE = 16.83

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)
1 3.03 8.52 4.670 18.40
2 16.83 9.65 4.309 6.01

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/HOUR)
1 17.89 8.52 4.670
2 19.63 9.65 4.309

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 19.63 Tc(MIN.) = 9.65
TOTAL AREA(ACRES) = 24.4
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 100.20 = 821.00 FEET.

*****
FLOW PROCESS FROM NODE 100.20 TO NODE 200.20 IS CODE = 41
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING USER-SPECIFIED PIPE SIZE (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 269.50 DOWNSTREAM(FEET) = 265.90
FLOW LENGTH(FEET) = 112.50 MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 12.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 12.55
GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 19.63
PIPE TRAVEL TIME(MIN.) = 0.15 Tc(MIN.) = 9.80
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 200.20 = 933.50 FEET.

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FLOW PROCESS FROM NODE 200.20 TO NODE 200.20 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 9.80
RAINFALL INTENSITY(INCH/HR) = 4.27
TOTAL STREAM AREA(ACRES) = 24.41
PEAK FLOW RATE(CFS) AT CONFLUENCE = 19.63

*****
FLOW PROCESS FROM NODE 200.00 TO NODE 200.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 198.00
UPSTREAM ELEVATION(FEET) = 285.10
DOWNSTREAM ELEVATION(FEET) = 283.40
ELEVATION DIFFERENCE(FEET) = 1.70
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.643
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 60.76
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.484
SUBAREA RUNOFF(CFS) = 1.43
TOTAL AREA(ACRES) = 0.40 TOTAL RUNOFF(CFS) = 1.43

*****
FLOW PROCESS FROM NODE 200.10 TO NODE 200.20 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STANDARD CURB SECTION USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 283.40 DOWNSTREAM ELEVATION(FEET) = 268.60
STREET LENGTH(FEET) = 678.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 9.61
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.37
HALFSTREET FLOOD WIDTH(FEET) = 12.00
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.08
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.13
STREET FLOW TRAVEL TIME(MIN.) = 3.67 Tc(MIN.) = 10.31
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.130
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650
SUBAREA AREA(ACRES) = 6.03 SUBAREA RUNOFF(CFS) = 16.19
TOTAL AREA(ACRES) = 6.4 PEAK FLOW RATE(CFS) = 17.26

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END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.43  HALFSTREET FLOOD WIDTH(FEET) = 15.27
FLOW VELOCITY(FEET/SEC.) = 3.52  DEPTH*VELOCITY(FT*FT/SEC.) = 1.52
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 200.20 = 876.00 FEET.

*****
FLOW PROCESS FROM NODE 200.20 TO NODE 200.20 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 10.31
RAINFALL INTENSITY(INCH/HR) = 4.13
TOTAL STREAM AREA(ACRES) = 6.43
PEAK FLOW RATE(CFS) AT CONFLUENCE = 17.26

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/ HOUR) (ACRE)
1 19.63 9.80 4.266 24.41
2 17.26 10.31 4.130 6.43

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/ HOUR)
1 36.04 9.80 4.266
2 36.26 10.31 4.130

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 36.26 Tc(MIN.) = 10.31
TOTAL AREA(ACRES) = 30.8
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 200.20 = 933.50 FEET.

*****
FLOW PROCESS FROM NODE 200.20 TO NODE 300.20 IS CODE = 41
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 265.90 DOWNSTREAM(FEET) = 262.57
FLOW LENGTH(FEET) = 333.00 MANNING'S N = 0.013
ASSUME FULL-FLOWING PIPELINE
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.75
(Pipe FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
AT DEPTH = 0.94 * DIAMETER)
GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 36.26
PIPE TRAVEL TIME(MIN.) = 0.72 Tc(MIN.) = 11.03
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 300.20 = 1266.50 FEET.

*****
FLOW PROCESS FROM NODE 300.20 TO NODE 300.20 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 11.03
RAINFALL INTENSITY(INCH/HR) = 3.95

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TOTAL STREAM AREA(ACRES) = 30.84
PEAK FLOW RATE(CFS) AT CONFLUENCE = 36.26

*****
FLOW PROCESS FROM NODE 300.00 TO NODE 300.10 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 187.00
UPSTREAM ELEVATION(FEET) = 269.40
DOWNSTREAM ELEVATION(FEET) = 268.00
ELEVATION DIFFERENCE(FEET) = 1.40
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.762
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 57.46
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/ HOUR) = 5.421
SUBAREA RUNOFF(CFS) = 1.34
TOTAL AREA(ACRES) = 0.38 TOTAL RUNOFF(CFS) = 1.34

*****
FLOW PROCESS FROM NODE 300.10 TO NODE 300.20 IS CODE = 61
-----
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STANDARD CURB SECTION USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 268.00 DOWNSTREAM ELEVATION(FEET) = 266.20
STREET LENGTH(FEET) = 210.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.52
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.38
HALFSTREET FLOOD WIDTH(FEET) = 12.86
AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.98
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.76
STREET FLOW TRAVEL TIME(MIN.) = 1.76 Tc(MIN.) = 8.53
100 YEAR RAINFALL INTENSITY(INCH/ HOUR) = 4.669
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .6500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.650
SUBAREA AREA(ACRES) = 1.43 SUBAREA RUNOFF(CFS) = 4.34
TOTAL AREA(ACRES) = 1.8 PEAK FLOW RATE(CFS) = 5.49

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.43 HALFSTREET FLOOD WIDTH(FEET) = 15.36
FLOW VELOCITY(FEET/SEC.) = 2.22 DEPTH*VELOCITY(FT*FT/SEC.) = 0.96
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 300.20 = 397.00 FEET.

*****
FLOW PROCESS FROM NODE 300.20 TO NODE 300.20 IS CODE = 1

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=====
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 8.53
RAINFALL INTENSITY(INCH/HR) = 4.67
TOTAL STREAM AREA(ACRES) = 1.81
PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.49

** CONFLUENCE DATA **
STREAM RUNOFF Tc INTENSITY AREA
NUMBER (CFS) (MIN.) (INCH/HR) (ACRE)
1 36.26 11.03 3.955 30.84
2 5.49 8.53 4.669 1.81

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

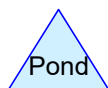
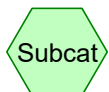
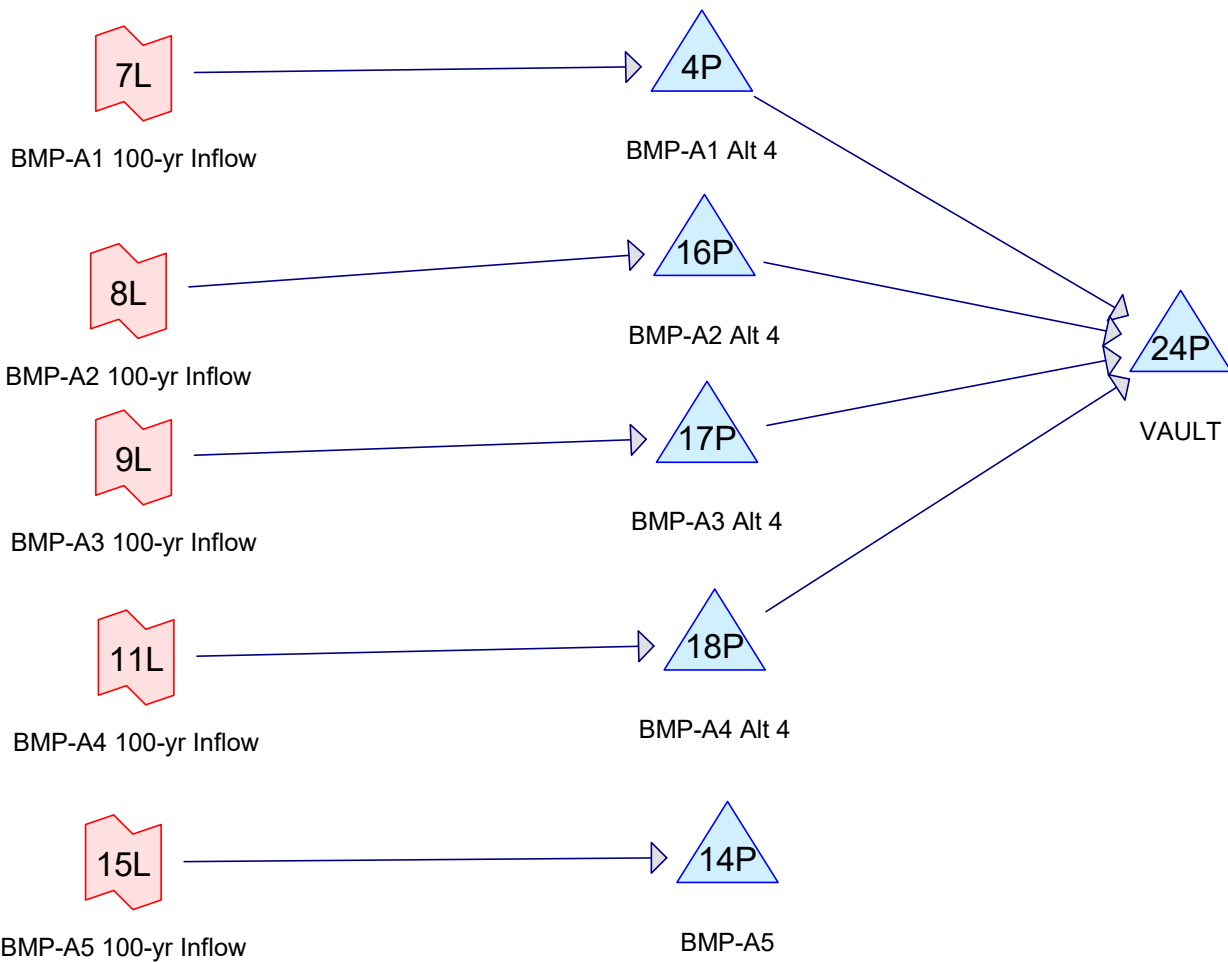
** PEAK FLOW RATE TABLE **
STREAM RUNOFF Tc INTENSITY
NUMBER (CFS) (MIN.) (INCH/HR)
1 36.21 8.53 4.669
2 40.91 11.03 3.955

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 40.91 Tc(MIN.) = 11.03
TOTAL AREA(ACRES) = 32.7
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 300.20 = 1266.50 FEET.
=====
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 32.7 TC(MIN.) = 11.03
PEAK FLOW RATE(CFS) = 40.91
=====
END OF RATIONAL METHOD ANALYSIS

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## **APPENDIX F**

### **Hydrograph and Detention Calculations**



#### Routing Diagram for 3084\_Alt4

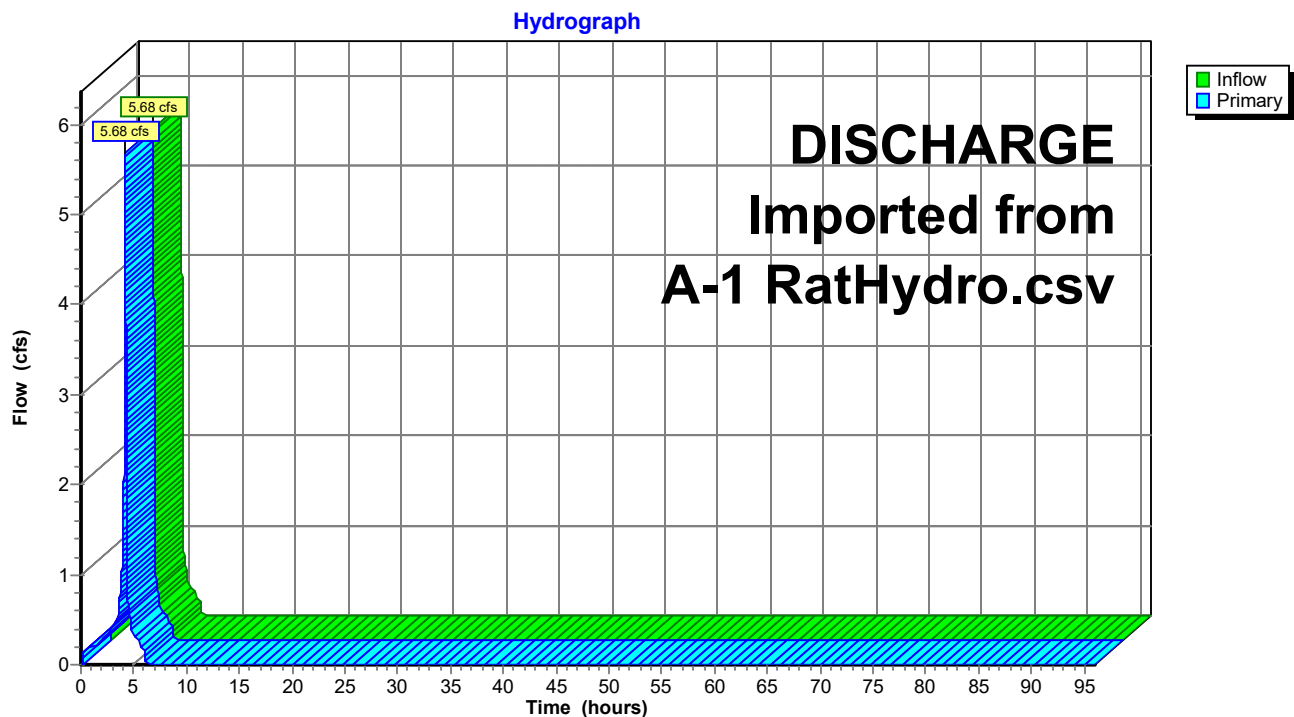
Prepared by Pasco Laret Suiter & Associates, Printed 7/22/2020  
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**Summary for Link 7L: BMP-A1 100-yr Inflow**

Inflow = 5.68 cfs @ 4.20 hrs, Volume= 0.255 af  
Primary = 5.68 cfs @ 4.20 hrs, Volume= 0.255 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

DISCHARGE Imported from A-1 RatHydro.csv

**Link 7L: BMP-A1 100-yr Inflow**

**3084\_Alt4**

Prepared by Pasco Laret Suiter &amp; Associates

Printed 7/22/2020

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**Summary for Pond 4P: BMP-A1 Alt 4**

Inflow = 5.68 cfs @ 4.20 hrs, Volume= 0.255 af  
 Outflow = 0.75 cfs @ 4.28 hrs, Volume= 0.255 af, Atten= 87%, Lag= 4.8 min  
 Primary = 0.75 cfs @ 4.28 hrs, Volume= 0.255 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

Peak Elev= 97.43' @ 6.02 hrs Surf.Area= 1,532 sf Storage= 5,724 cf

Plug-Flow detention time= 563.1 min calculated for 0.255 af (100% of inflow)

Center-of-Mass det. time= 563.1 min ( 782.8 - 219.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	10,801 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	1,532	0.0	0	0	1,532
98.50	1,532	95.0	7,277	7,277	2,226
100.00	1,532	20.0	460	7,737	2,434
102.00	1,532	100.0	3,064	10,801	2,711

Device	Routing	Invert	Outlet Devices
#1	Primary	93.50'	<b>18.0" Round Culvert</b> L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 93.50' / 92.50' S= 0.0100 ' S= 0.0100 ' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	93.50'	<b>4.0" Vert. Orifice</b> C= 0.600 Limited to weir flow at low heads
#3	Device 1	101.50'	<b>36.0" x 36.0" Horiz. Grate</b> C= 0.600 in 36.0" x 36.0" Grate (100% open area) Limited to weir flow at low heads

**Primary OutFlow** Max=0.75 cfs @ 4.28 hrs HW=96.89' TW=93.68' (Dynamic Tailwater)

1=Culvert (Passes 0.75 cfs of 13.86 cfs potential flow)

2=Orifice (Orifice Controls 0.75 cfs @ 8.63 fps)

3=Grate ( Controls 0.00 cfs)

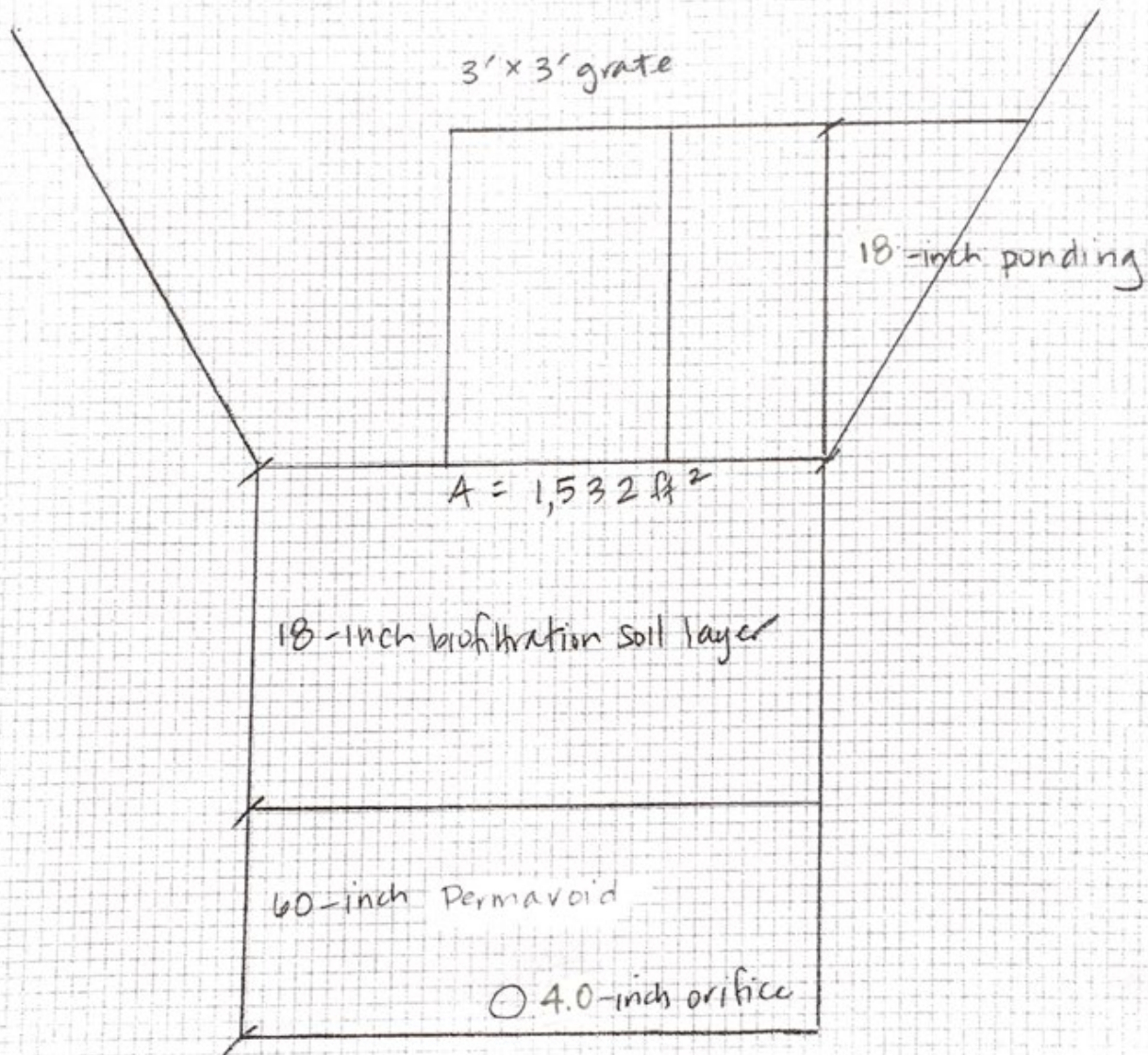
# PASCO LARET SUITER & ASSOCIATES

Fox Point

Date 5/8/2020

Job# 3089

HMP Biofiltration Basin BMP-A1

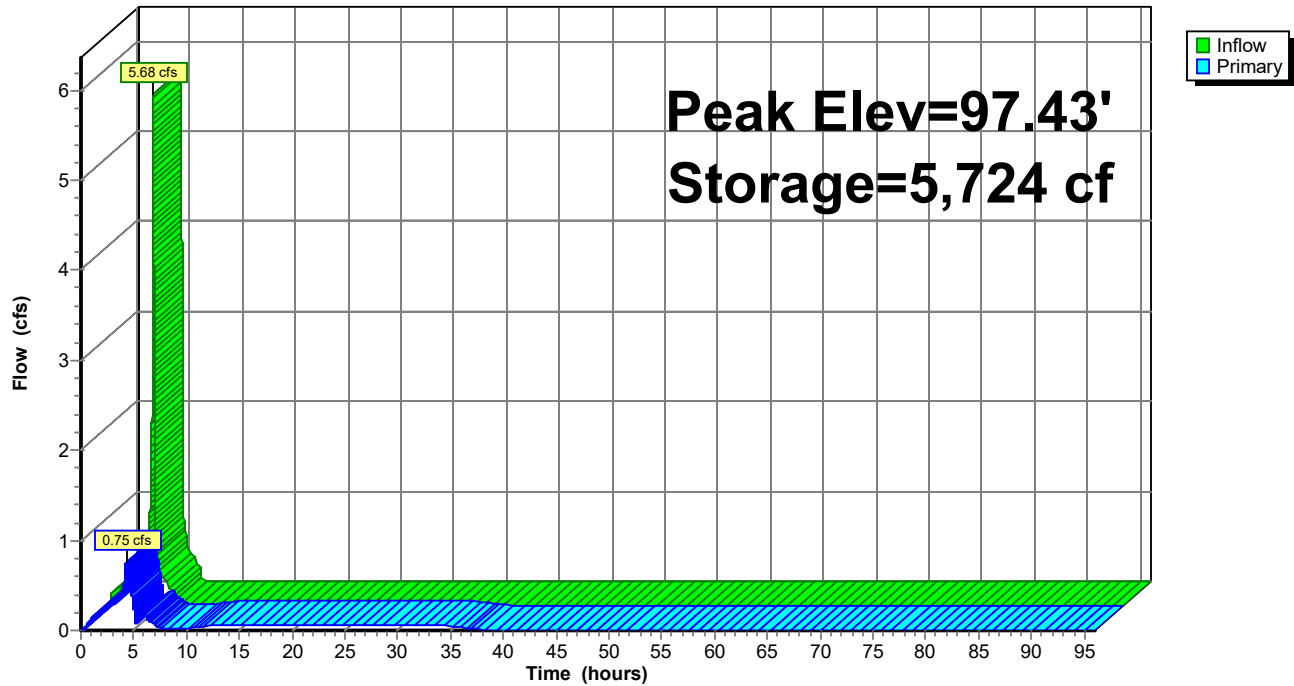


Not to scale

A1 + #6

## Pond 4P: BMP-A1 Alt 4

## Hydrograph

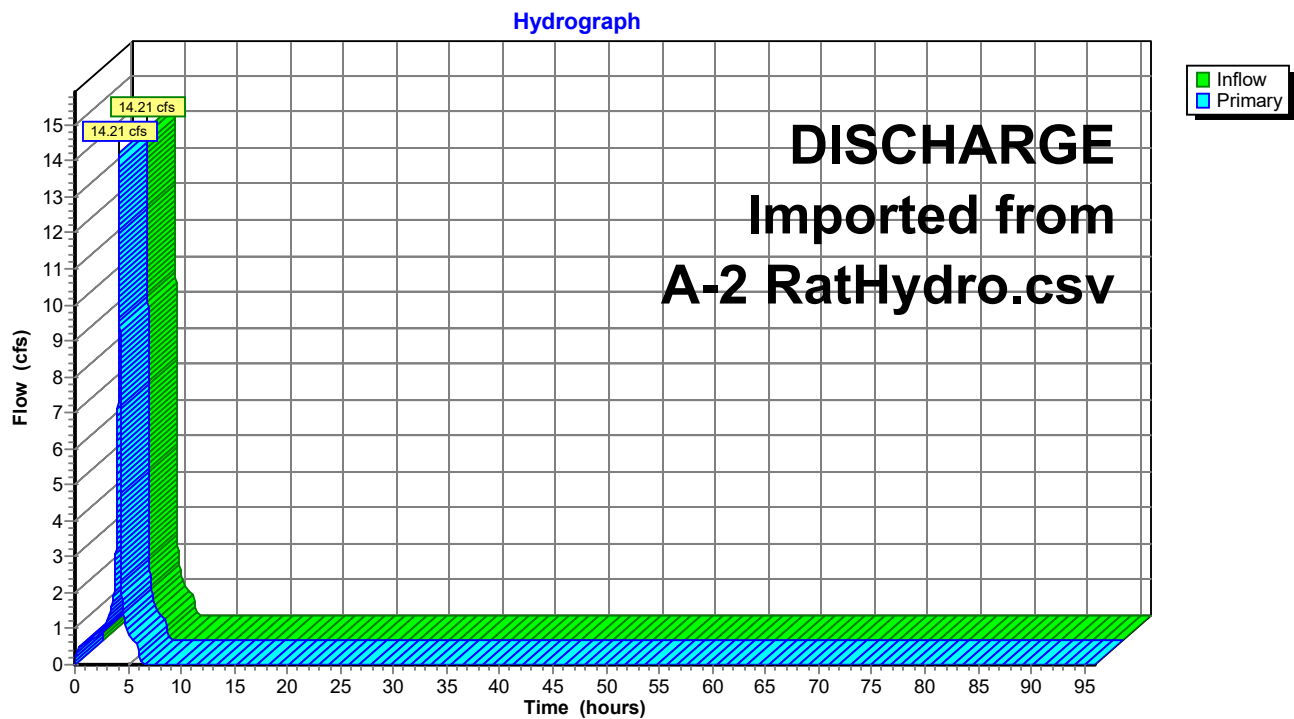


**Summary for Link 8L: BMP-A2 100-yr Inflow**

Inflow = 14.21 cfs @ 4.17 hrs, Volume= 0.713 af  
Primary = 14.21 cfs @ 4.17 hrs, Volume= 0.713 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

DISCHARGE Imported from A-2 RatHydro.csv

**Link 8L: BMP-A2 100-yr Inflow**

**3084\_Alt4**

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**Summary for Pond 16P: BMP-A2 Alt 4**

Inflow = 14.21 cfs @ 4.17 hrs, Volume= 0.713 af  
 Outflow = 0.96 cfs @ 4.32 hrs, Volume= 0.712 af, Atten= 93%, Lag= 9.4 min  
 Primary = 0.96 cfs @ 4.32 hrs, Volume= 0.712 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

Peak Elev= 100.16' @ 5.31 hrs Surf.Area= 4,010 sf Storage= 20,898 cf

Plug-Flow detention time= 616.6 min calculated for 0.712 af (100% of inflow)

Center-of-Mass det. time= 616.5 min ( 832.8 - 216.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	28,271 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	4,010	0.0	0	0	4,010
98.50	4,010	95.0	19,048	19,048	5,132
100.00	4,010	20.0	1,203	20,251	5,469
102.00	4,010	100.0	8,020	28,271	5,918

Device	Routing	Invert	Outlet Devices
#1	Primary	93.50'	<b>18.0" Round Culvert</b> L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 93.50' / 92.50' S= 0.0100 ' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	93.50'	<b>4.0" Vert. Orifice</b> C= 0.600 Limited to weir flow at low heads
#3	Device 1	101.50'	<b>36.0" x 36.0" Horiz. Grate</b> C= 0.600 in 36.0" x 36.0" Grate (100% open area) Limited to weir flow at low heads

**Primary OutFlow** Max=0.96 cfs @ 4.32 hrs HW=99.26' TW=94.07' (Dynamic Tailwater)

1=Culvert (Passes 0.96 cfs of 18.55 cfs potential flow)

2=Orifice (Orifice Controls 0.96 cfs @ 10.96 fps)

3=Grate ( Controls 0.00 cfs)

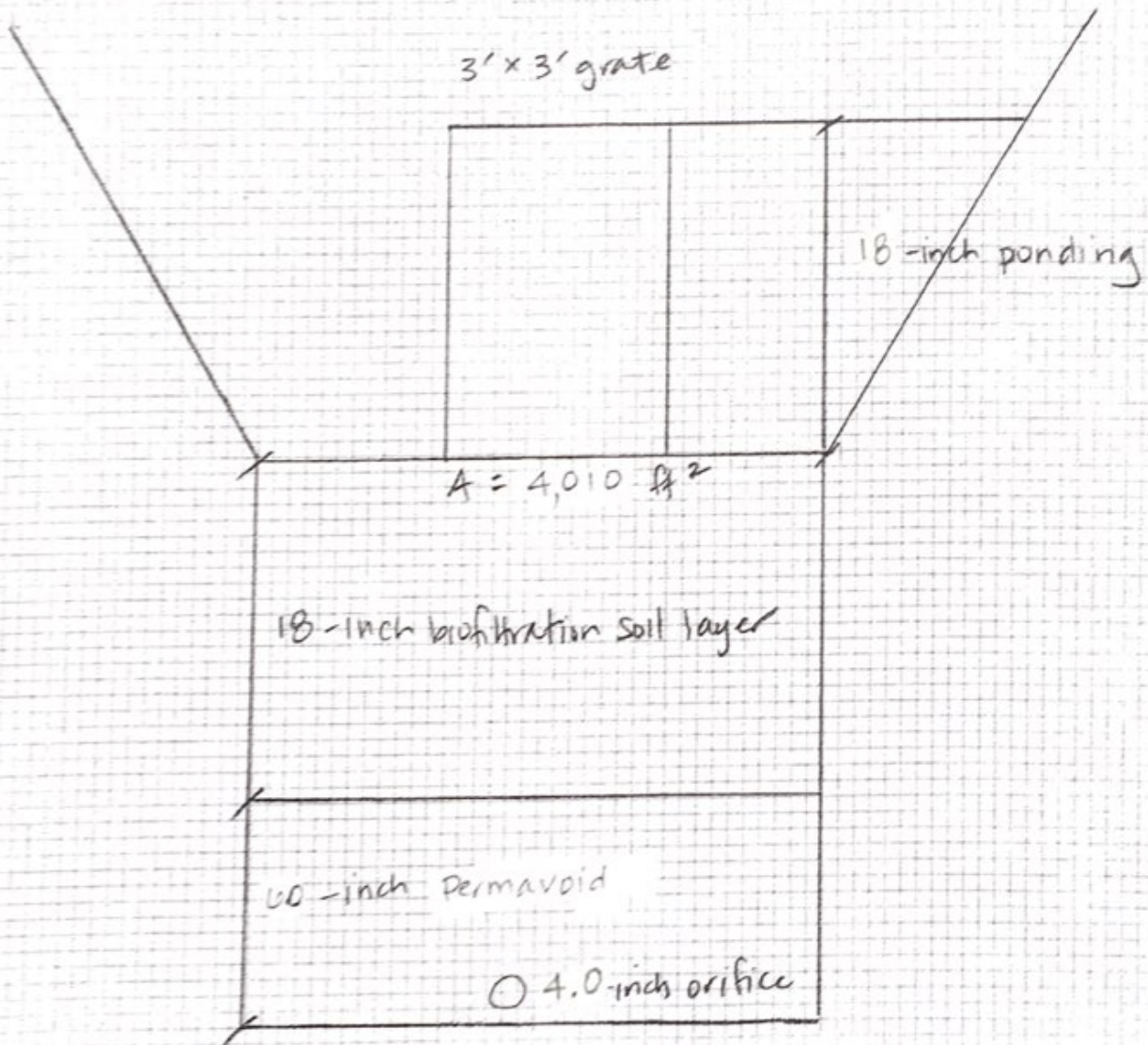
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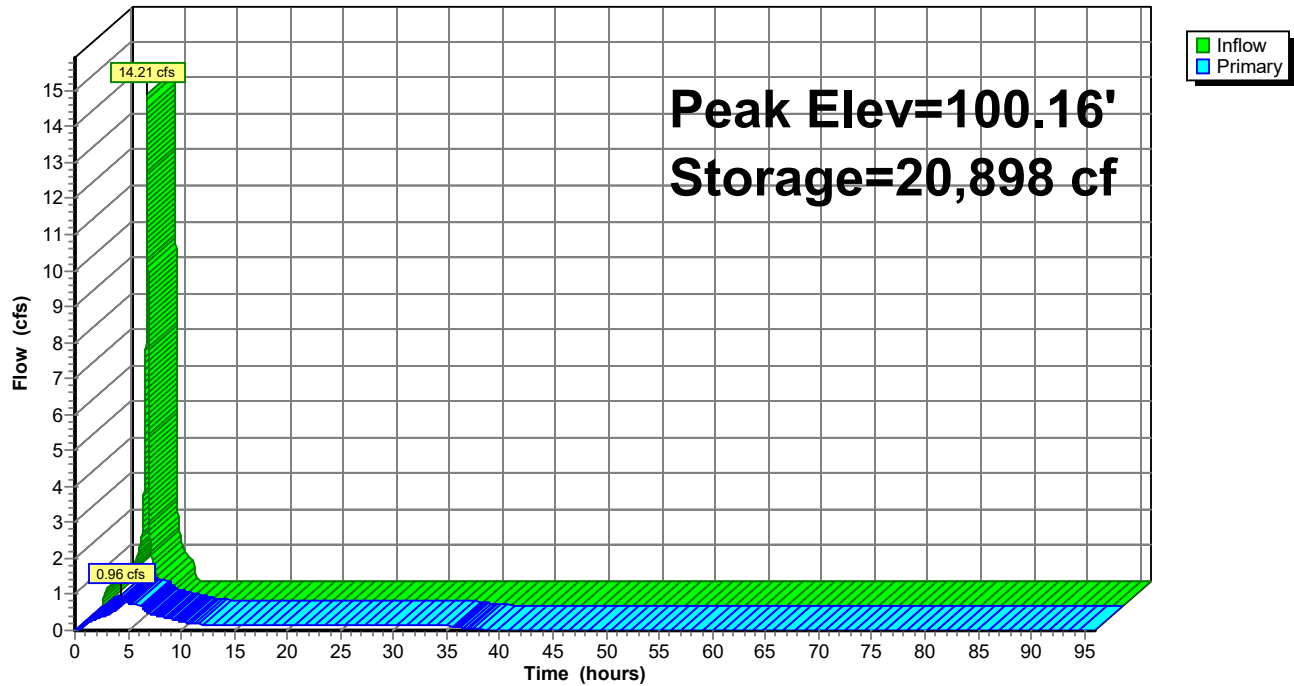
Job# 3084

HMP Biofiltration Basin BMP-A2



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Alt #6

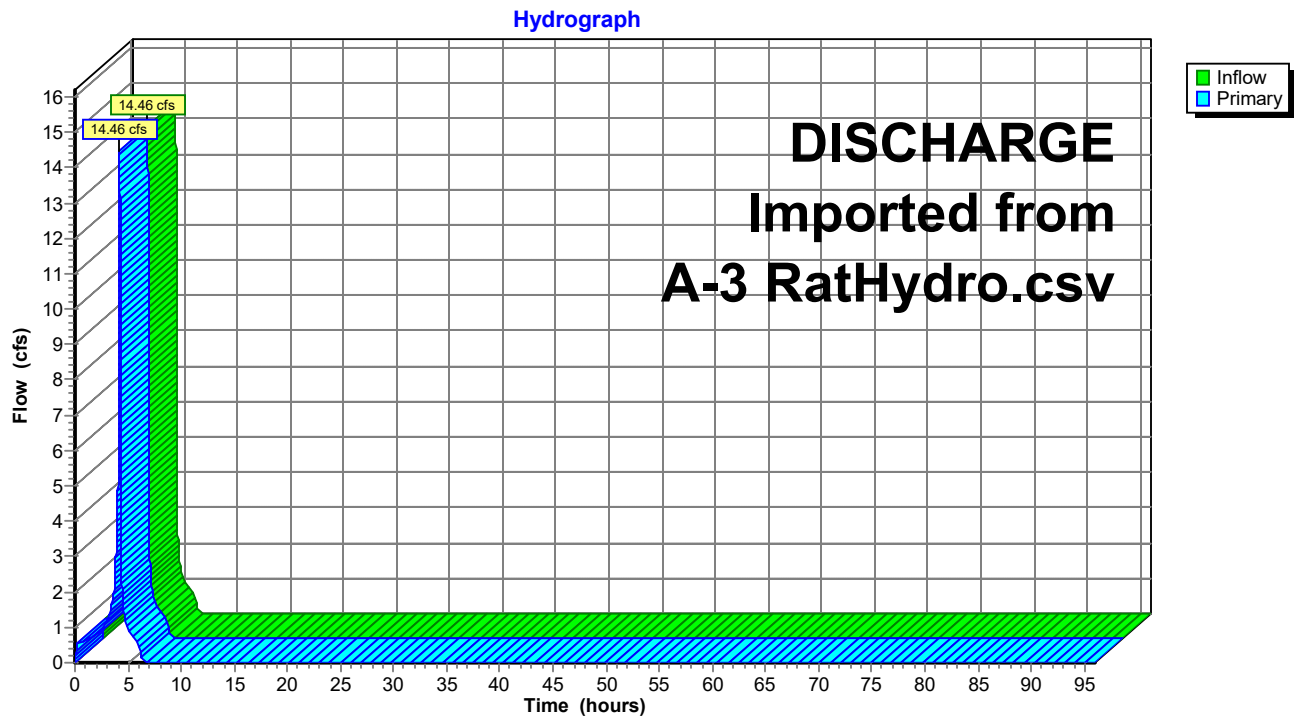
**Pond 16P: BMP-A2 Alt 4****Hydrograph**

**Summary for Link 9L: BMP-A3 100-yr Inflow**

Inflow = 14.46 cfs @ 4.22 hrs, Volume= 0.762 af  
Primary = 14.46 cfs @ 4.22 hrs, Volume= 0.762 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

DISCHARGE Imported from A-3 RatHydro.csv

**Link 9L: BMP-A3 100-yr Inflow**

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**Summary for Pond 17P: BMP-A3 Alt 4**

Inflow = 14.46 cfs @ 4.22 hrs, Volume= 0.762 af  
 Outflow = 0.90 cfs @ 4.40 hrs, Volume= 0.761 af, Atten= 94%, Lag= 10.8 min  
 Primary = 0.90 cfs @ 4.40 hrs, Volume= 0.761 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

Peak Elev= 100.17' @ 5.47 hrs Surf.Area= 4,388 sf Storage= 22,927 cf

Plug-Flow detention time= 639.9 min calculated for 0.761 af (100% of inflow)

Center-of-Mass det. time= 639.8 min ( 858.6 - 218.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	30,935 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	4,388	0.0	0	0	4,388
98.50	4,388	95.0	20,843	20,843	5,562
100.00	4,388	20.0	1,316	22,159	5,914
102.00	4,388	100.0	8,776	30,935	6,384

Device	Routing	Invert	Outlet Devices
#1	Primary	93.50'	<b>18.0" Round Culvert</b> L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 93.50' / 92.50' S= 0.0100 ' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	93.50'	<b>4.0" Vert. Orifice</b> C= 0.600 Limited to weir flow at low heads
#3	Device 1	101.50'	<b>36.0" x 36.0" Horiz. Grate</b> C= 0.600 in 36.0" x 36.0" Grate (100% open area) Limited to weir flow at low heads

**Primary OutFlow** Max=0.90 cfs @ 4.40 hrs HW=99.24' TW=94.66' (Dynamic Tailwater)

1=Culvert (Passes 0.90 cfs of 17.45 cfs potential flow)

2=Orifice (Orifice Controls 0.90 cfs @ 10.31 fps)

3=Grate ( Controls 0.00 cfs)

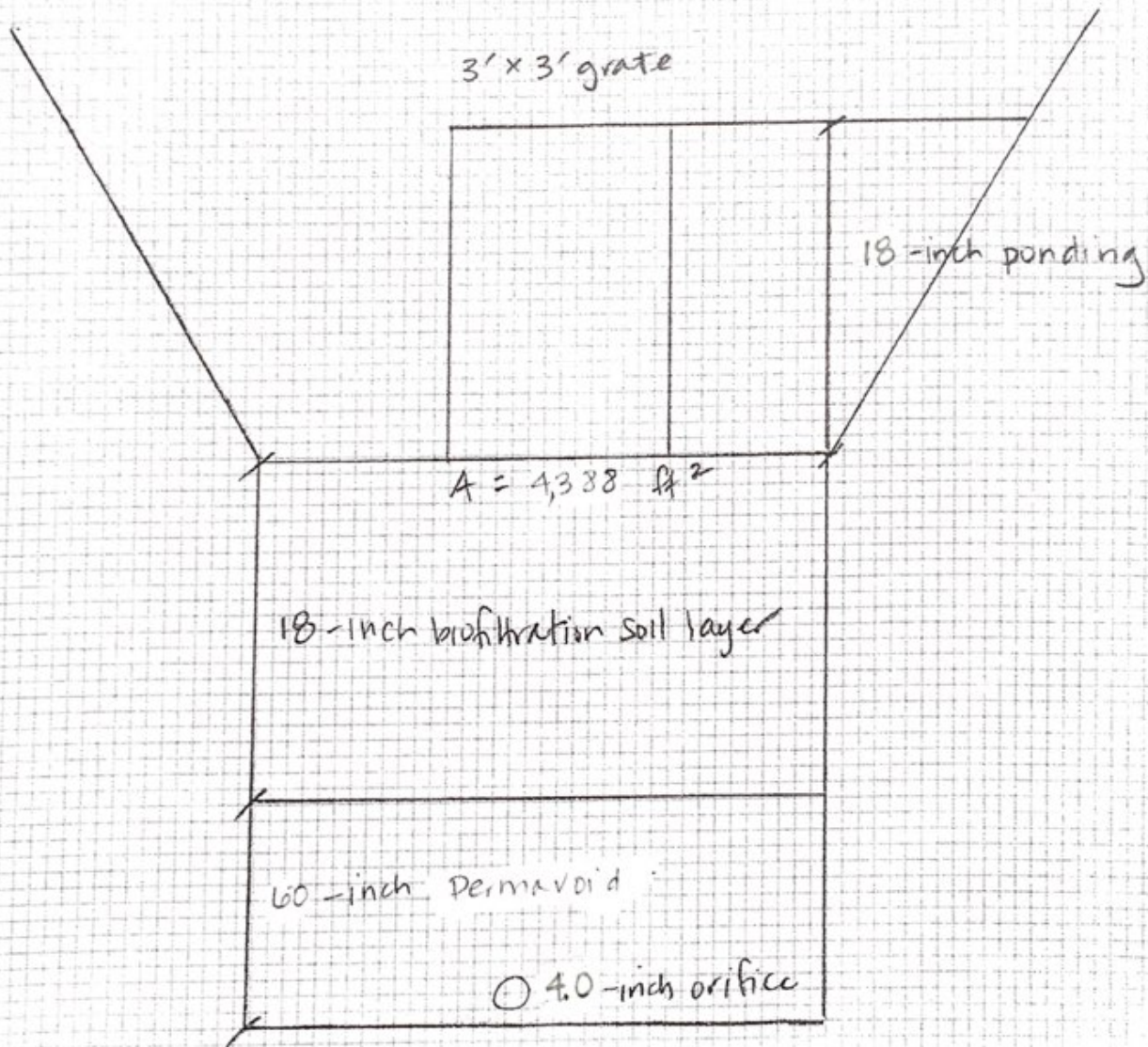
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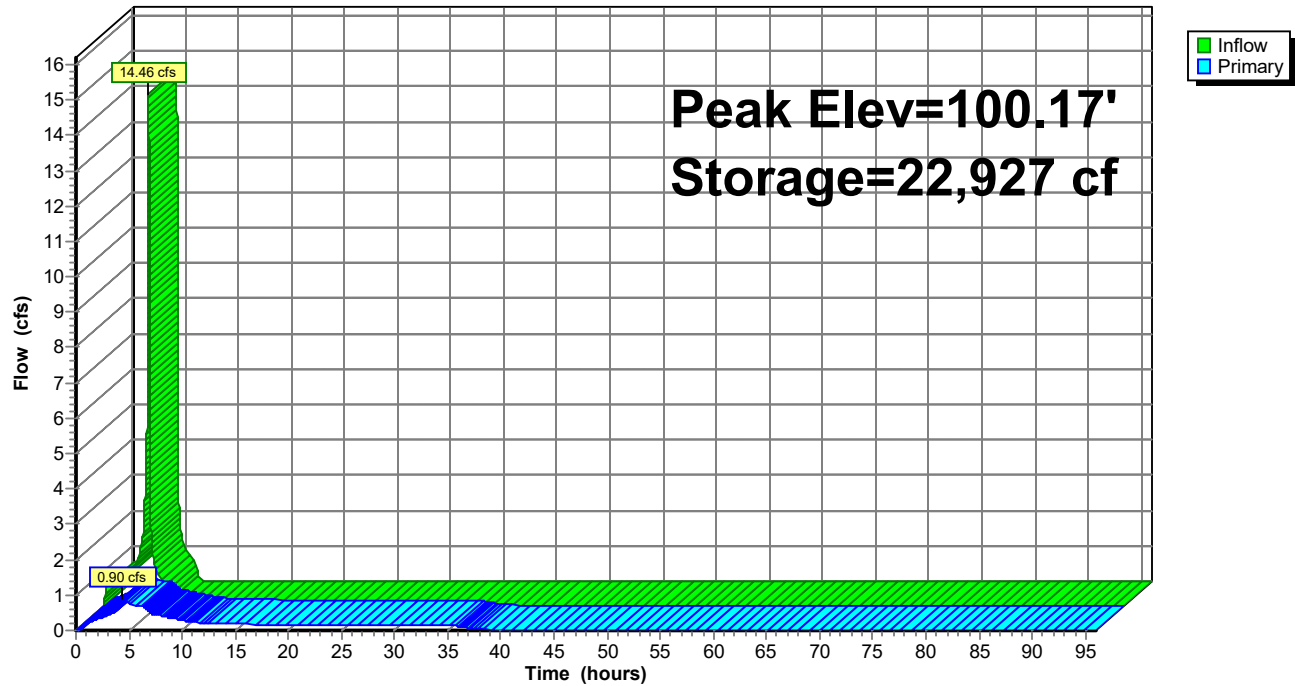
Job# 3084

HMP Biofiltration Basin BMP-A3



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Alt #6

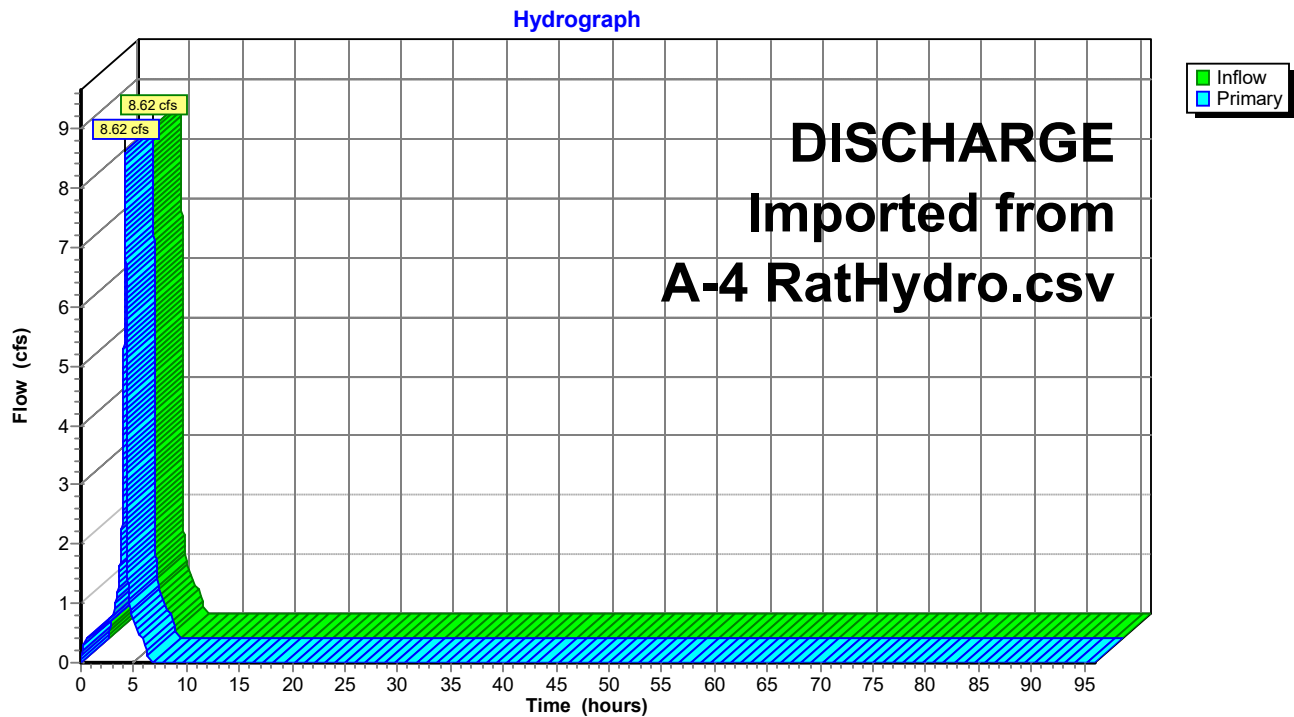
**Pond 17P: BMP-A3 Alt 4****Hydrograph**

**Summary for Link 11L: BMP-A4 100-yr Inflow**

Inflow = 8.62 cfs @ 4.20 hrs, Volume= 0.535 af  
Primary = 8.62 cfs @ 4.20 hrs, Volume= 0.535 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

DISCHARGE Imported from A-4 RatHydro.csv

**Link 11L: BMP-A4 100-yr Inflow**

**3084\_Alt4**

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**Summary for Pond 18P: BMP-A4 Alt 4**

Inflow = 8.62 cfs @ 4.20 hrs, Volume= 0.535 af  
 Outflow = 5.28 cfs @ 4.31 hrs, Volume= 0.534 af, Atten= 39%, Lag= 6.5 min  
 Primary = 5.28 cfs @ 4.31 hrs, Volume= 0.534 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

Peak Elev= 101.72' @ 4.31 hrs Surf.Area= 1,609 sf Storage= 10,896 cf

Plug-Flow detention time= 324.6 min calculated for 0.534 af (100% of inflow)

Center-of-Mass det. time= 324.7 min ( 542.8 - 218.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	11,343 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	1,609	0.0	0	0	1,609
98.50	1,609	95.0	7,643	7,643	2,320
100.00	1,609	20.0	483	8,125	2,533
102.00	1,609	100.0	3,218	11,343	2,818

Device	Routing	Invert	Outlet Devices
#1	Primary	93.50'	<b>18.0" Round Culvert</b> L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 93.50' / 92.50' S= 0.0100 ' S= 0.0100 ' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	93.50'	<b>4.0" Vert. Orifice</b> C= 0.600 Limited to weir flow at low heads
#3	Device 1	101.50'	<b>36.0" x 36.0" Horiz. Grate</b> C= 0.600 in 36.0" x 36.0" Grate (100% open area) Limited to weir flow at low heads

**Primary OutFlow** Max=5.28 cfs @ 4.31 hrs HW=101.72' TW=93.93' (Dynamic Tailwater)

1=Culvert (Passes 5.28 cfs of 22.64 cfs potential flow)

2=Orifice (Orifice Controls 1.17 cfs @ 13.44 fps)

3=Grate (Weir Controls 4.10 cfs @ 1.54 fps)

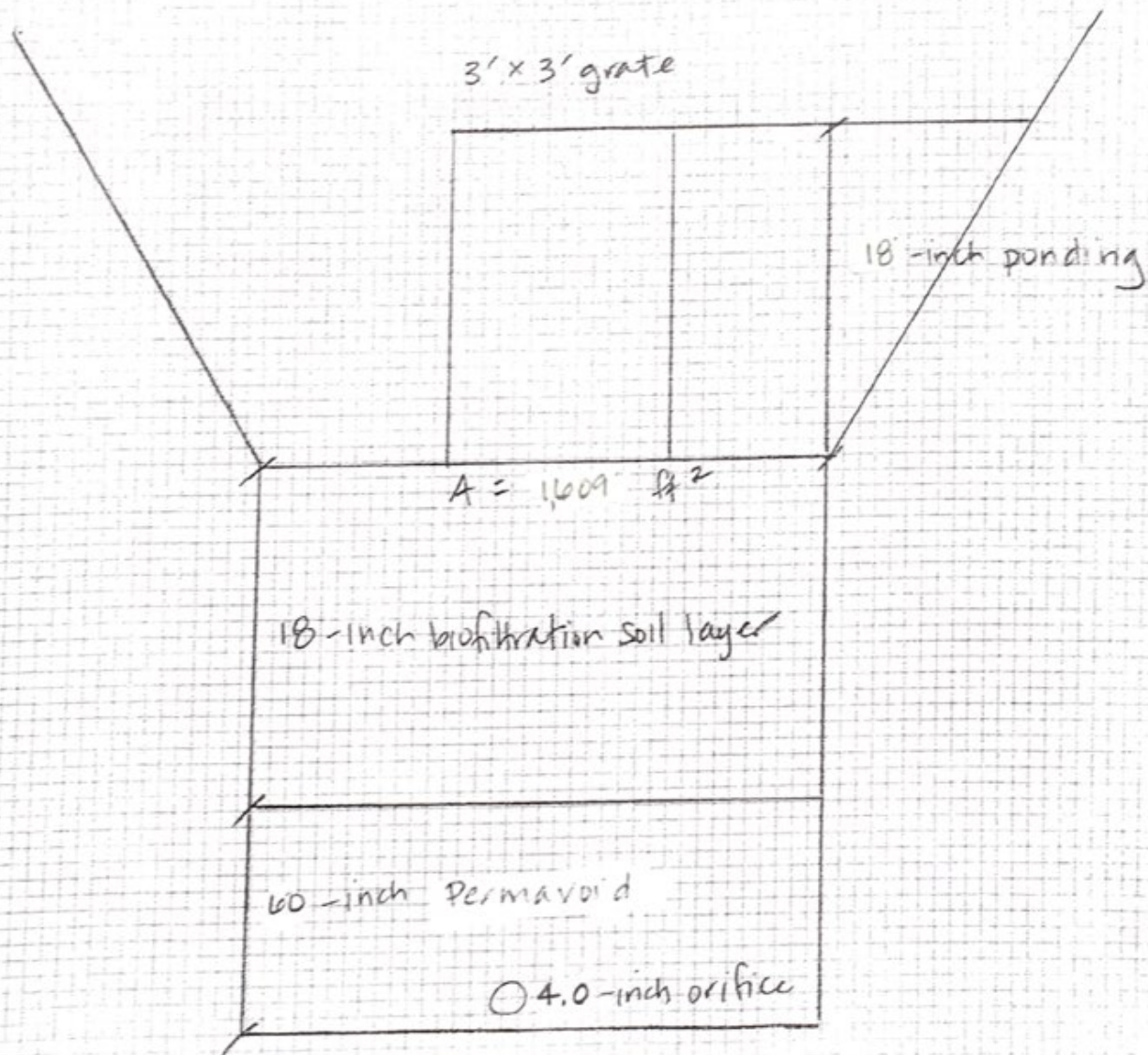
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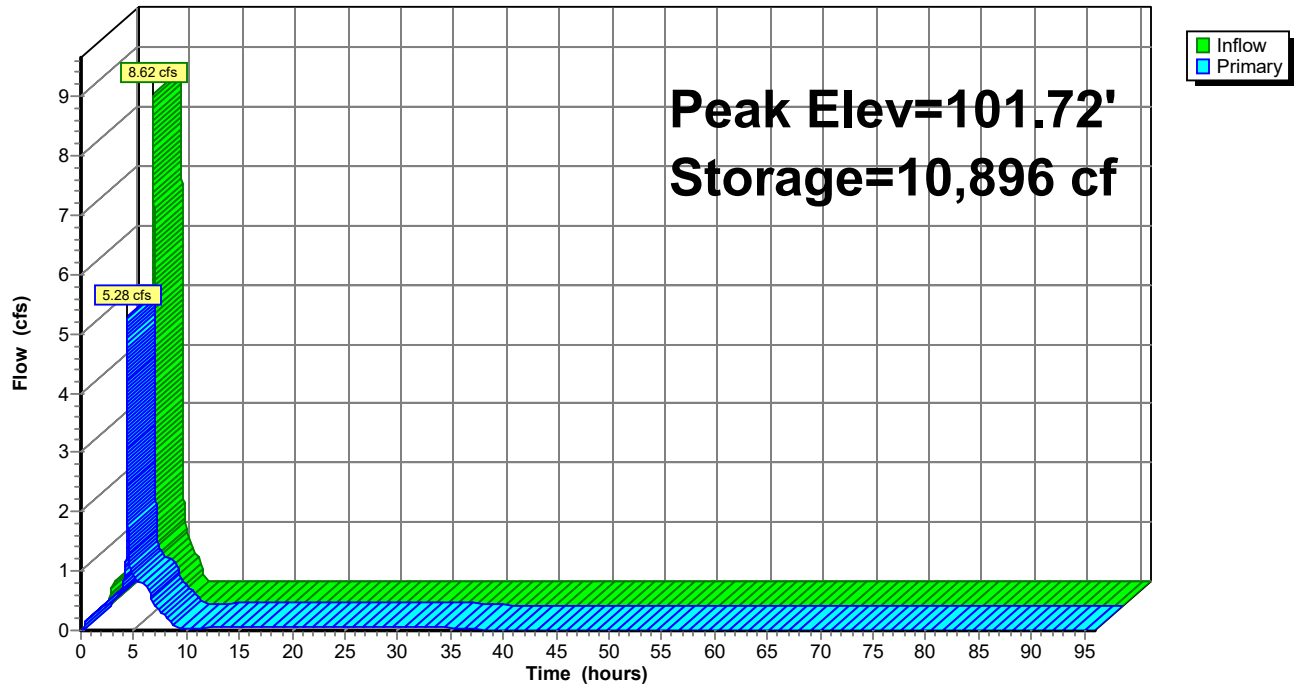
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HMP Biofiltration Basin BMP-A4



Not to scale

Alt #6

**Pond 18P: BMP-A4 Alt 4****Hydrograph**

**Summary for Pond 24P: VAULT**

Inflow = 7.85 cfs @ 4.31 hrs, Volume= 2.263 af  
 Outflow = 2.38 cfs @ 5.70 hrs, Volume= 2.262 af, Atten= 70%, Lag= 83.6 min  
 Primary = 2.38 cfs @ 5.70 hrs, Volume= 2.262 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

Peak Elev= 97.27' @ 5.70 hrs Surf.Area= 2,809 sf Storage= 27,160 cf

Plug-Flow detention time= 532.8 min calculated for 2.262 af (100% of inflow)

Center-of-Mass det. time= 531.0 min ( 1,298.3 - 767.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	87.60'	36,517 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
87.60	2,809	0.0	0	0	2,809
100.60	2,809	100.0	36,517	36,517	5,251

Device	Routing	Invert	Outlet Devices
#1	Primary	87.60'	<b>36.0" Round Culvert</b> L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 87.60' / 86.60' S= 0.0100 ' S= 0.0100 ' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	87.60'	<b>2.7" Vert. Orifice</b> C= 0.600 Limited to weir flow at low heads
#3	Device 1	97.00'	<b>24.0" W x 6.0" H Vert. Orifice X 2.00</b> C= 0.600 Limited to weir flow at low heads
#4	Device 1	100.10'	<b>Custom Weir, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.50 0.50 Width (feet) 45.00 45.00 0.00

**Primary OutFlow** Max=2.38 cfs @ 5.70 hrs HW=97.27' (Free Discharge)

1=Culvert (Passes 2.38 cfs of 113.19 cfs potential flow)

2=Orifice (Orifice Controls 0.59 cfs @ 14.88 fps)

3=Orifice (Orifice Controls 1.79 cfs @ 1.67 fps)

4=Custom Weir ( Controls 0.00 cfs)

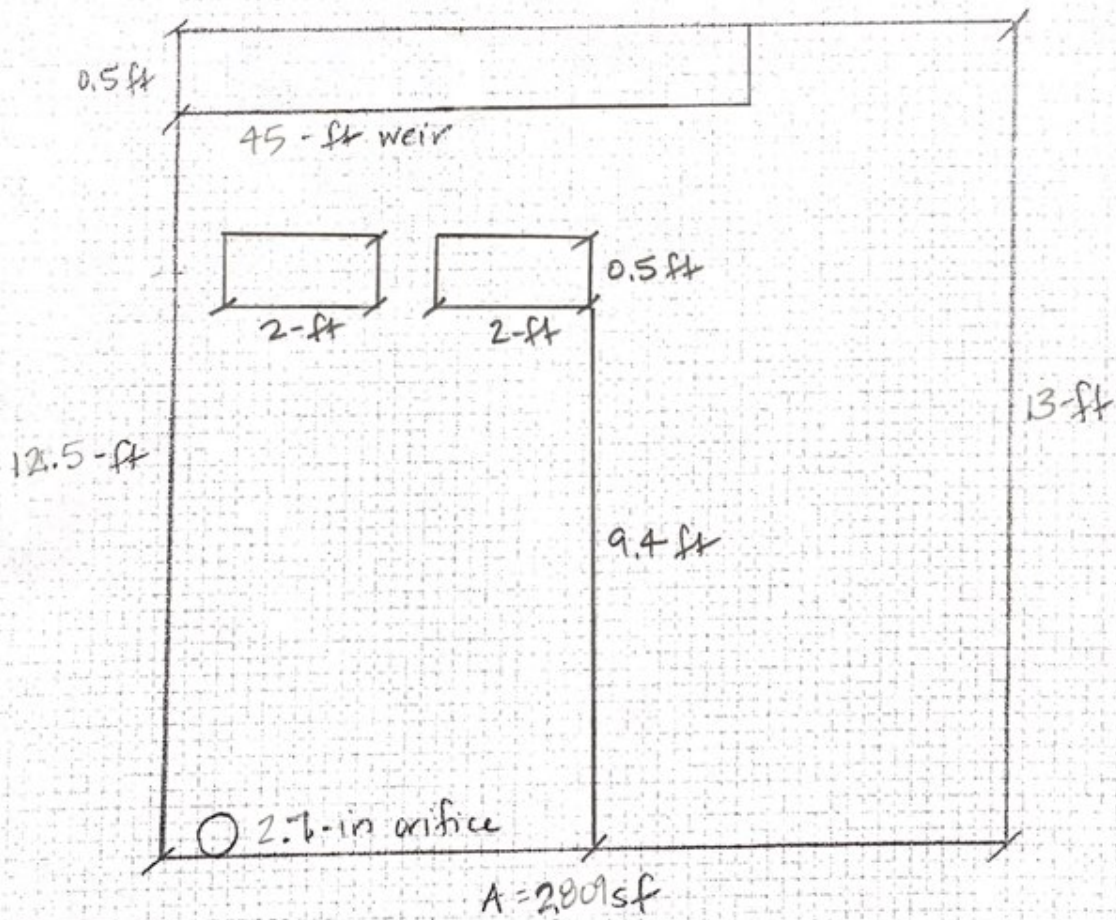
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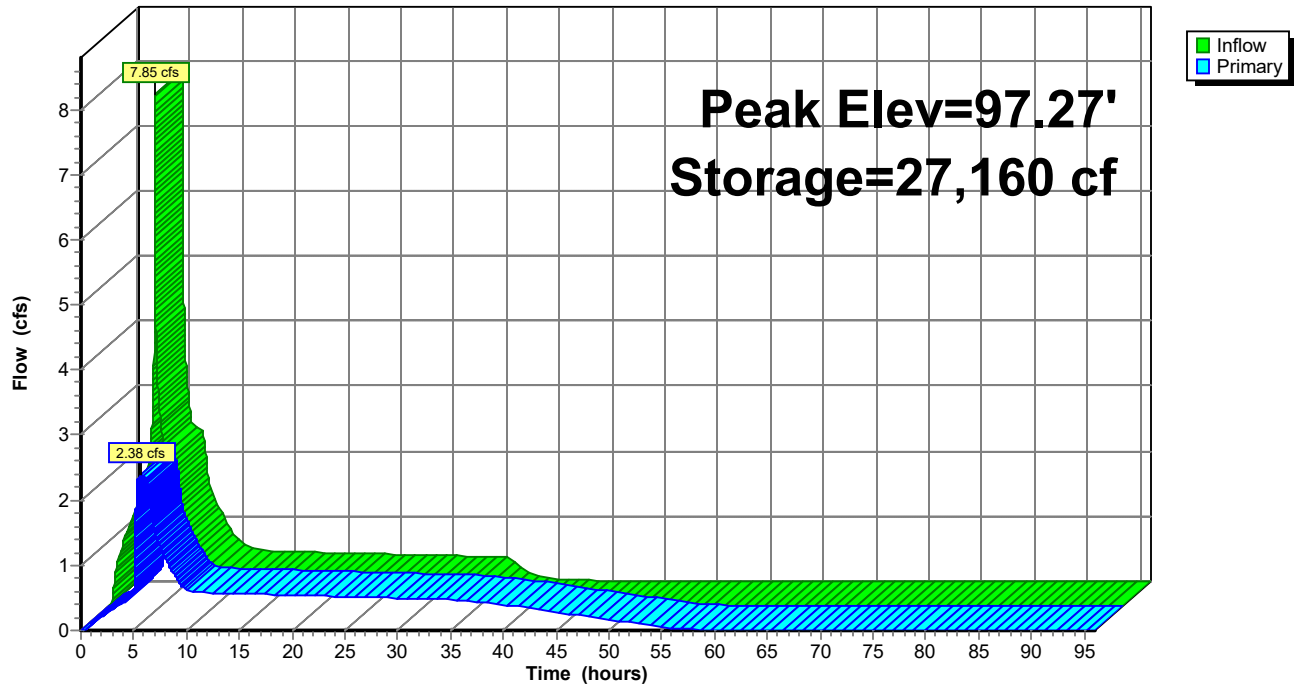
Job# 3084

Vault



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Att # 6

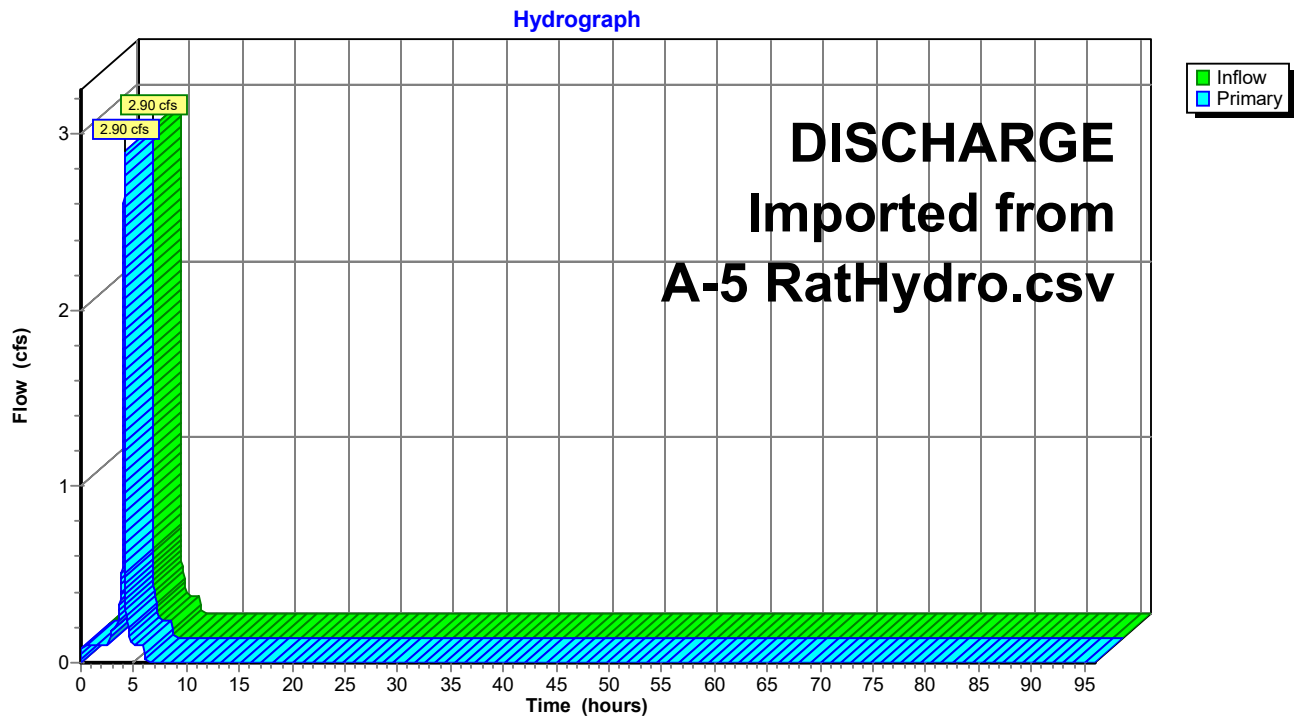
**Pond 24P: VAULT****Hydrograph**

**Summary for Link 15L: BMP-A5 100-yr Inflow**

Inflow = 2.90 cfs @ 4.08 hrs, Volume= 0.097 af  
Primary = 2.90 cfs @ 4.08 hrs, Volume= 0.097 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

DISCHARGE Imported from A-5 RatHydro.csv

**Link 15L: BMP-A5 100-yr Inflow**

**Summary for Pond 14P: BMP-A5**

Inflow = 2.90 cfs @ 4.08 hrs, Volume= 0.097 af  
 Outflow = 2.87 cfs @ 4.08 hrs, Volume= 0.097 af, Atten= 1%, Lag= 0.1 min  
 Primary = 2.87 cfs @ 4.08 hrs, Volume= 0.097 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

Peak Elev= 101.17' @ 4.08 hrs Surf.Area= 221 sf Storage= 956 cf

Plug-Flow detention time= 215.3 min calculated for 0.097 af (100% of inflow)

Center-of-Mass det. time= 215.4 min ( 424.3 - 208.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	95.50'	1,028 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
95.50	221	0.0	0	0	221
98.50	221	95.0	630	630	379
100.00	221	20.0	66	696	458
101.50	221	100.0	332	1,028	537

Device	Routing	Invert	Outlet Devices
#1	Primary	95.50'	<b>12.0" Round Culvert</b> L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 95.50' / 94.50' S= 0.0100 ' S= 0.0100 ' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	95.50'	<b>0.5" Vert. Orifice</b> C= 0.600 Limited to weir flow at low heads
#3	Device 1	101.00'	<b>36.0" x 36.0" Horiz. Grate</b> C= 0.600 in 36.0" x 36.0" Grate (100% open area) Limited to weir flow at low heads

**Primary OutFlow** Max=2.86 cfs @ 4.08 hrs HW=101.17' (Free Discharge)

1=Culvert (Passes 2.86 cfs of 7.21 cfs potential flow)

2=Orifice (Orifice Controls 0.02 cfs @ 11.45 fps)

3=Grate (Weir Controls 2.85 cfs @ 1.36 fps)

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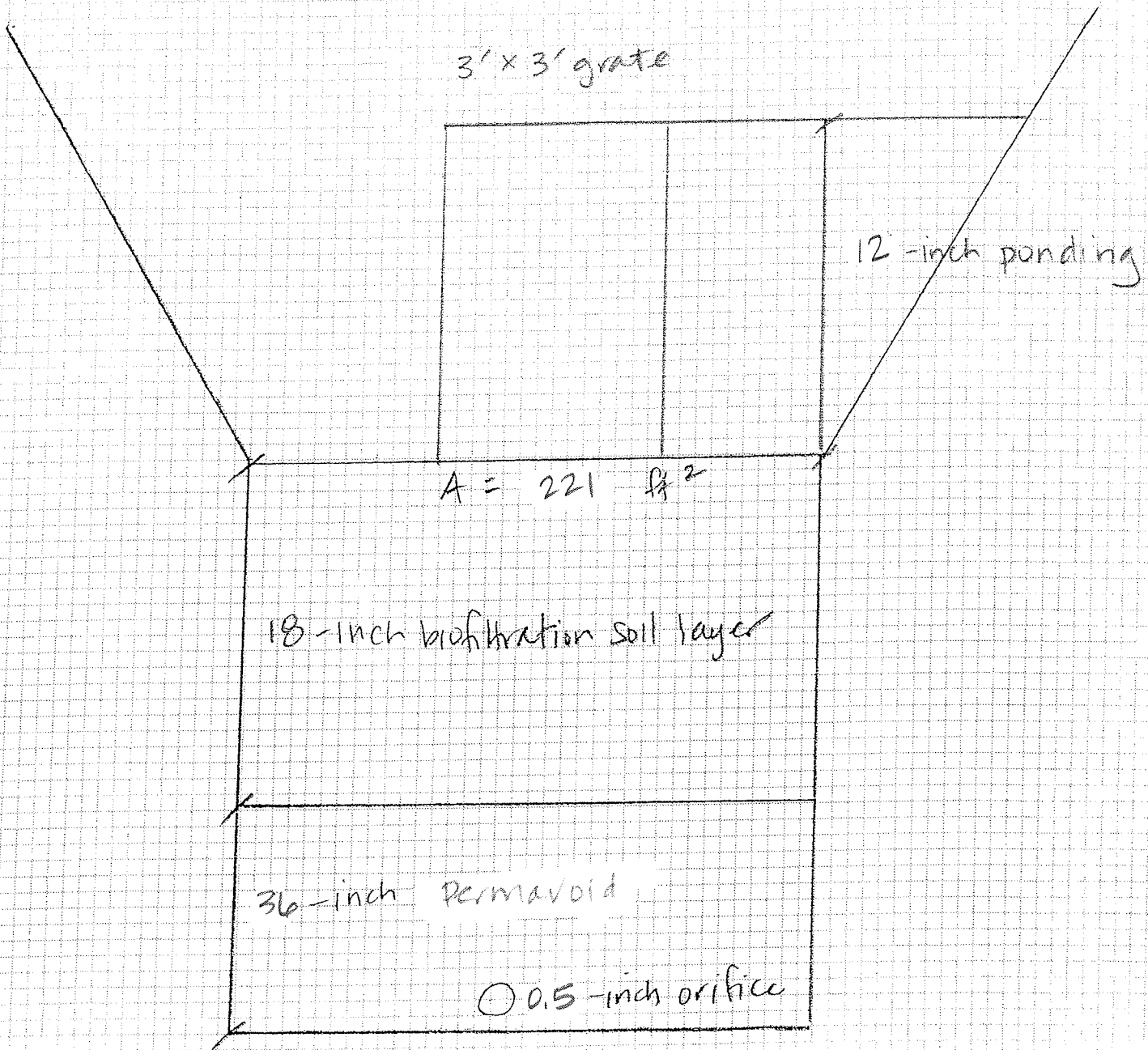
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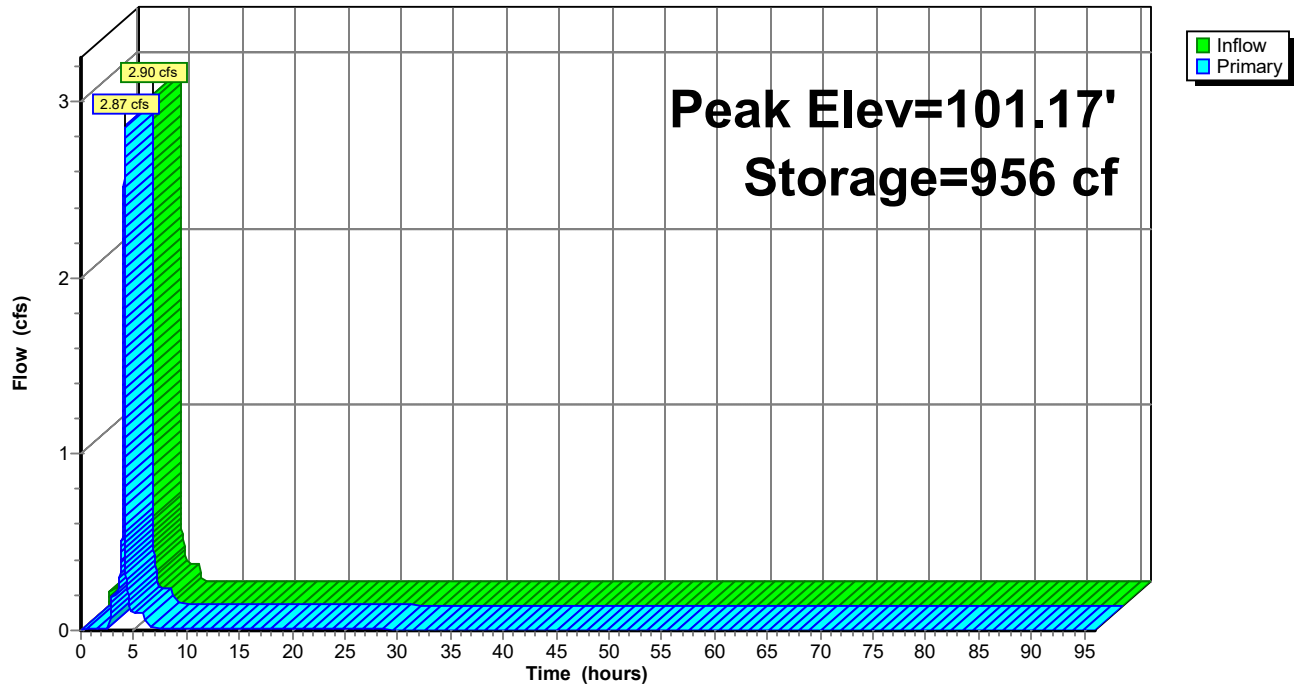
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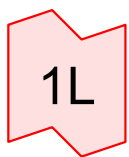
HMP Biofiltration Basin BMP-A5



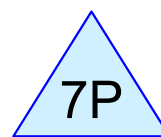
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Att #3

**Pond 14P: BMP-A5****Hydrograph**



BMP-B1 100-yr Inflow



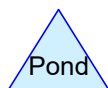
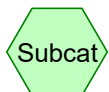
BMP-B1



BMP-B2 100-yr Inflow



BMP-B2



**Routing Diagram for 3084\_Alt4**

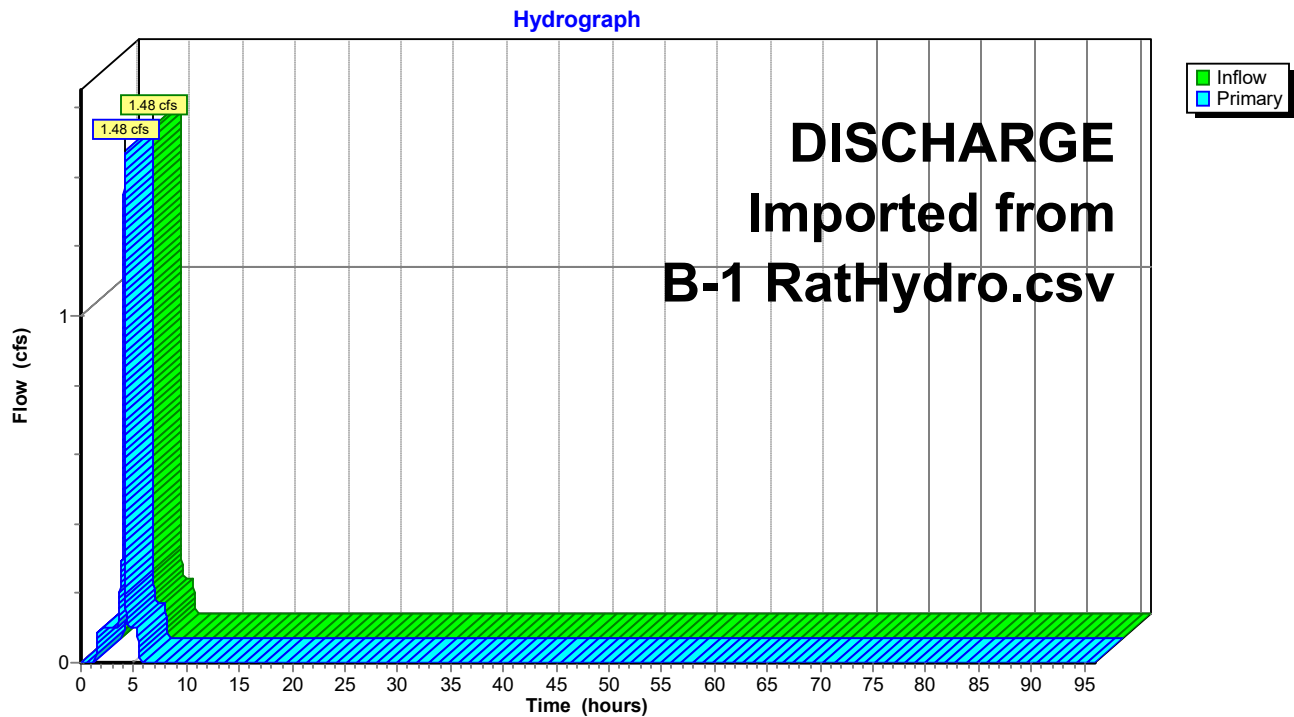
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**Summary for Link 1L: BMP-B1 100-yr Inflow**

Inflow = 1.48 cfs @ 4.08 hrs, Volume= 0.053 af  
Primary = 1.48 cfs @ 4.08 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

DISCHARGE Imported from B-1 RatHydro.csv

**Link 1L: BMP-B1 100-yr Inflow**

**Summary for Pond 7P: BMP-B1**

Inflow = 1.48 cfs @ 4.08 hrs, Volume= 0.053 af  
 Outflow = 1.42 cfs @ 4.09 hrs, Volume= 0.053 af, Atten= 4%, Lag= 0.4 min  
 Primary = 1.42 cfs @ 4.09 hrs, Volume= 0.053 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

Peak Elev= 101.11' @ 4.09 hrs Surf.Area= 546 sf Storage= 1,288 cf

Plug-Flow detention time= 697.3 min calculated for 0.053 af (100% of inflow)

Center-of-Mass det. time= 697.2 min ( 916.8 - 219.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	97.50'	1,502 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
97.50	546	0.0	0	0	546
98.50	546	95.0	519	519	629
100.00	546	20.0	164	683	753
101.50	546	100.0	819	1,502	877

Device	Routing	Invert	Outlet Devices
#1	Primary	97.50'	<b>12.0" Round Culvert</b> L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 97.50' / 96.50' S= 0.0100 ' S= 0.0100 ' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	97.50'	<b>0.5" Vert. Orifice</b> C= 0.600 Limited to weir flow at low heads
#3	Device 1	101.00'	<b>36.0" x 36.0" Horiz. Grate</b> C= 0.600 in 36.0" x 36.0" Grate (100% open area) Limited to weir flow at low heads

**Primary OutFlow** Max=1.42 cfs @ 4.09 hrs HW=101.11' (Free Discharge)

1=Culvert (Passes 1.42 cfs of 5.75 cfs potential flow)

2=Orifice (Orifice Controls 0.01 cfs @ 9.12 fps)

3=Grate (Weir Controls 1.40 cfs @ 1.08 fps)

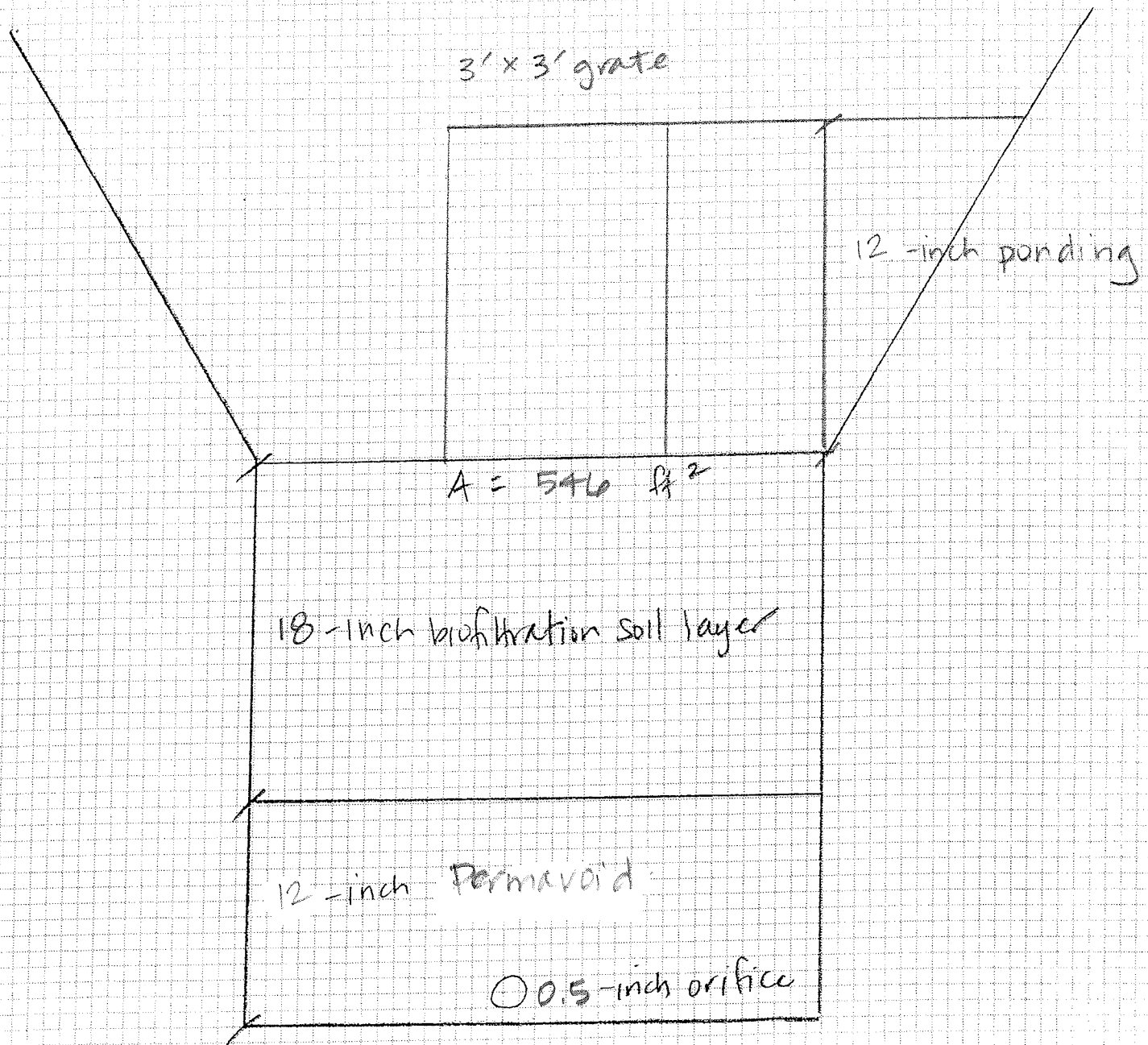
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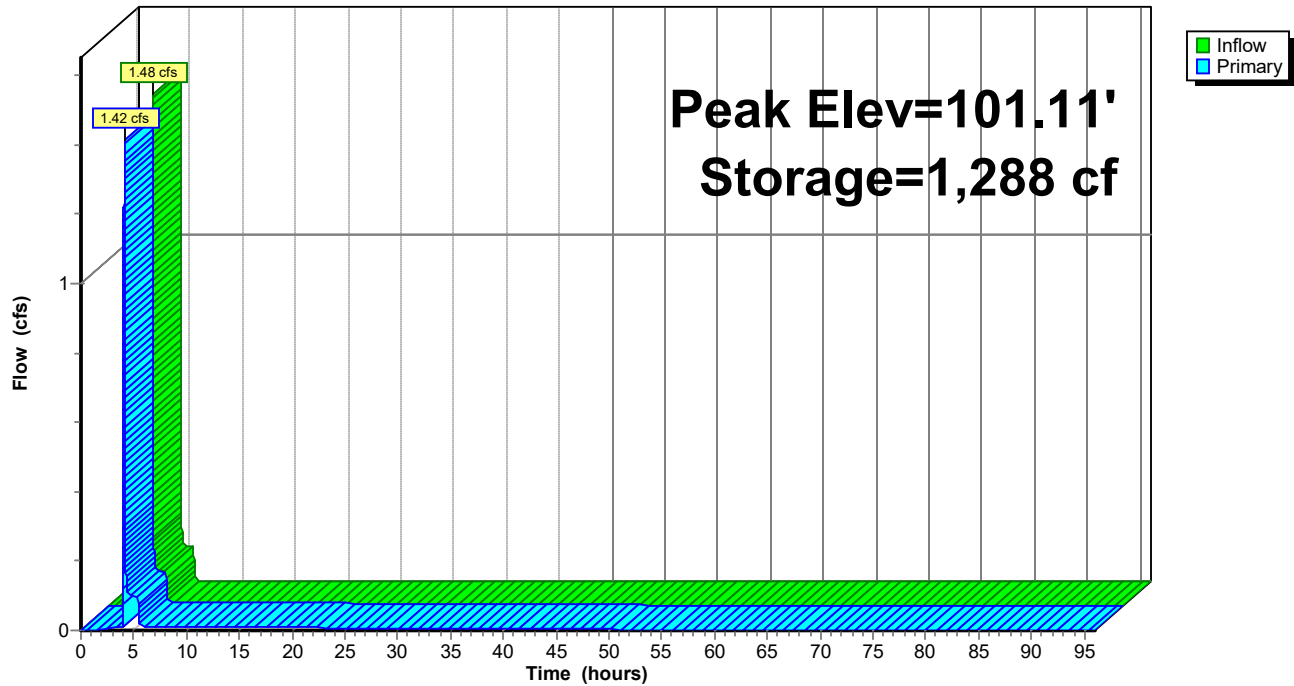
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Alt #3

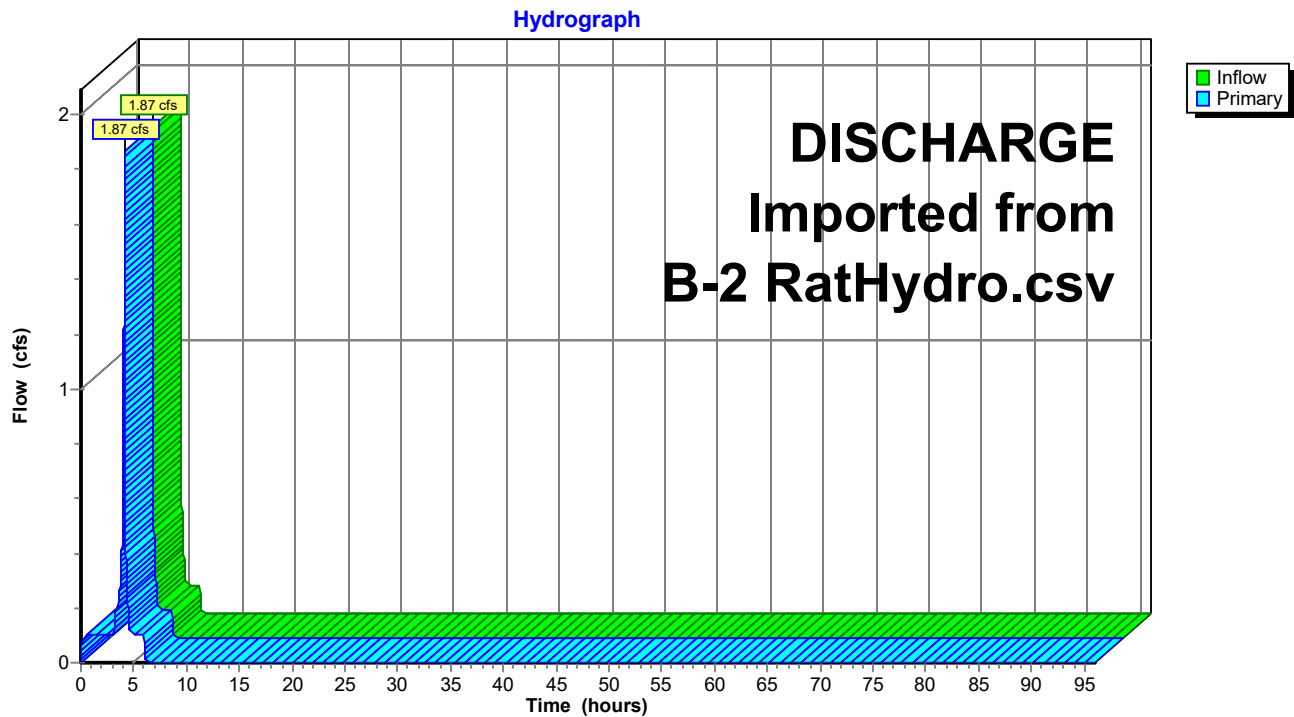
**Pond 7P: BMP-B1****Hydrograph**

**Summary for Link 2L: BMP-B2 100-yr Inflow**

Inflow = 1.87 cfs @ 4.13 hrs, Volume= 0.087 af  
Primary = 1.87 cfs @ 4.13 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

DISCHARGE Imported from B-2 RatHydro.csv

**Link 2L: BMP-B2 100-yr Inflow**

**Summary for Pond 25P: BMP-B2**

Inflow = 1.87 cfs @ 4.13 hrs, Volume= 0.087 af  
 Outflow = 1.83 cfs @ 4.14 hrs, Volume= 0.087 af, Atten= 2%, Lag= 0.2 min  
 Primary = 1.83 cfs @ 4.14 hrs, Volume= 0.087 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.001 hrs

Peak Elev= 101.13' @ 4.14 hrs Surf.Area= 400 sf Storage= 1,712 cf

Plug-Flow detention time= 665.1 min calculated for 0.087 af (100% of inflow)

Center-of-Mass det. time= 665.1 min ( 874.1 - 209.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	95.50'	1,860 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
95.50	400	0.0	0	0	400
98.50	400	95.0	1,140	1,140	613
100.00	400	20.0	120	1,260	719
101.50	400	100.0	600	1,860	825

Device	Routing	Invert	Outlet Devices
#1	Primary	95.50'	<b>12.0" Round Culvert</b> L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 95.50' / 95.35' S= 0.0100 ' / Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	95.50'	<b>0.5" Vert. Orifice</b> C= 0.600 Limited to weir flow at low heads
#3	Device 1	101.00'	<b>36.0" x 36.0" Horiz. Grate</b> C= 0.600 in 36.0" x 36.0" Grate (100% open area) Limited to weir flow at low heads

**Primary OutFlow** Max=1.83 cfs @ 4.14 hrs HW=101.13' (Free Discharge)

1=Culvert (Passes 1.83 cfs of 10.66 cfs potential flow)

2=Orifice (Orifice Controls 0.02 cfs @ 11.40 fps)

3=Grate (Weir Controls 1.81 cfs @ 1.17 fps)

# PASCO LARET SUITER

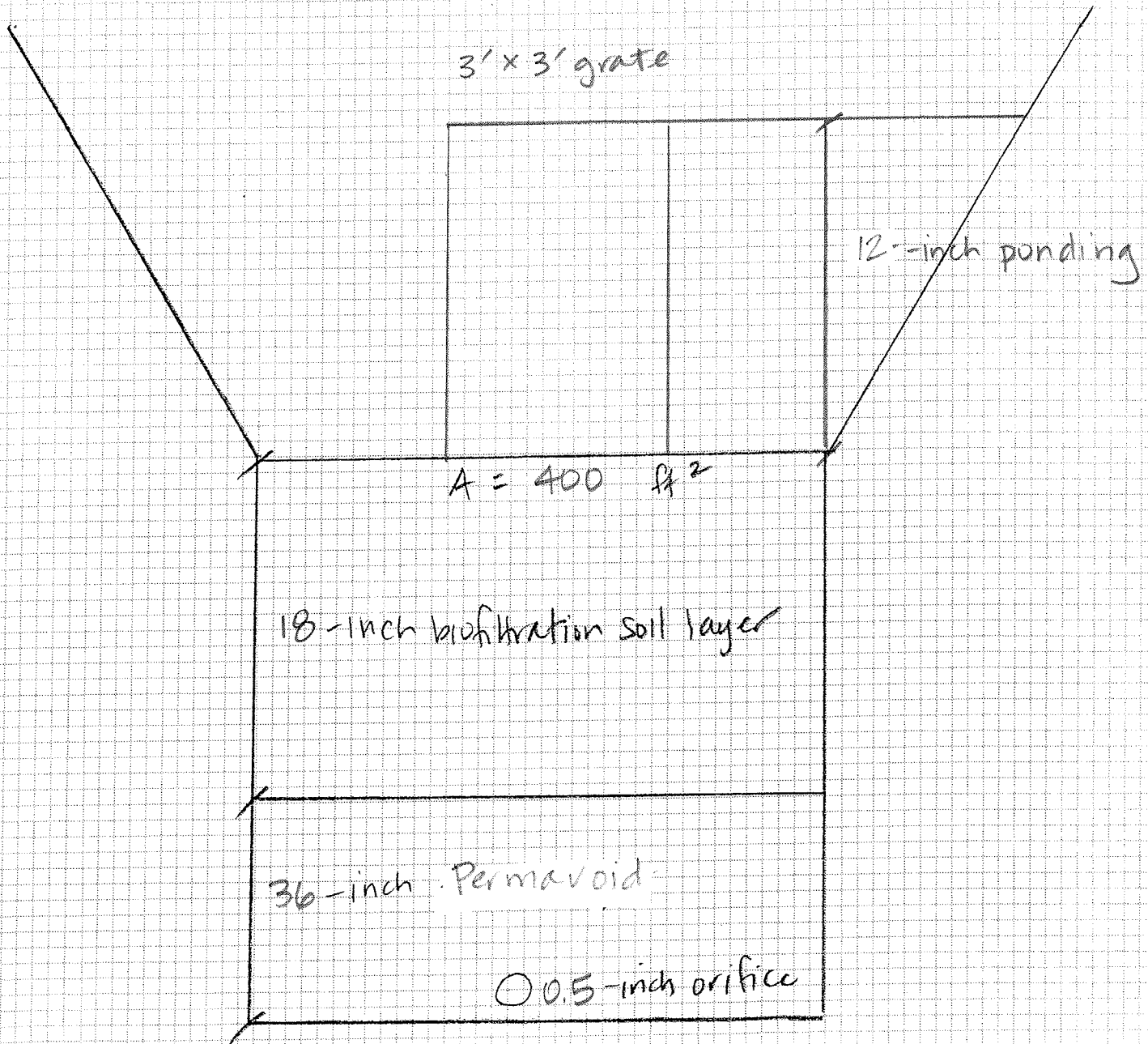
& ASSOCIATES

Fox Point

Date 2/26/2020

Job# 3089

HMP Biofiltration Basin BMP-B2



Not to scale

Alt #3

**Pond 25P: BMP-B2****Hydrograph**